

Final

Regional flows analysis – Collaborative RV grant project

23 FEBRUARY 2023

PREPARED FOR

City of Stonnington

Report title	Regional flows analysis – Collaborative RV grant project
Prepared for	City of Stonnington
Status	Final
Author(s)	Lisa McLeod, Lara Stovell
Reviewer(s)	Kyle O’Farrell, Joe Pickin
Project number	P1424
Report date	23 February 2023
Contract date	2 November 2022
Information current to	18 January 2023
Copyright	City of Stonnington, Blue Environment Pty Ltd

Disclaimer

This report has been prepared for City of Stonnington in accordance with the terms and conditions of appointment dated 2 November 2022, and is based on the assumptions and exclusions set out in our scope of work. Information in this document is current as of 18 January 2023. While all professional care has been undertaken in preparing this report, Blue Environment Pty Ltd cannot accept any responsibility for any use of or reliance on the contents of this report by any third party.

The mention of any company, product or process in this report does not constitute or imply endorsement by Blue Environment Pty Ltd.

© City of Stonnington, Blue Environment Pty Ltd

Blue Environment Pty Ltd
ABN 78 118 663 997
Suite 209, 838 Collins St, Docklands Vic 3008
Email: blue@blueenvironment.com.au
Web: www.blueenvironment.com.au
Phone: 03 9081 0440

Contents

Summary	1
Materials flow analysis	1
Key materials	1
Opportunities (interventions and actions)	2
Circularity and benchmarking.....	2
Recommendations.....	3
1. Introduction	4
1.1 Project objectives.....	4
1.2 Circular economy principles.....	4
1.3 Project scope.....	5
1.4 Project method	8
1.5 Limitations and assumptions	11
2. Stakeholder consultation	12
2.1 Preliminary consultations	12
2.2 Secondary consultation.....	12
2.3 Key takeaways.....	13
3. Materials flow analysis.....	15
3.1 Consumption.....	15
3.2 Stocks	18
3.3 End of life generation.....	19
3.4 Fates	22
4. Key materials.....	24
4.1 Key materials selection	24
4.2 Key material summary	26
4.3 Future materials for analysis.....	35
5. Intervention analysis and actions	36
5.1 MCA outcomes.....	36
5.2 Action plans.....	36
6. Circularity and benchmarking.....	51
6.1 Framework and metrics	51
6.2 Benchmarking	51
7. Conclusion and recommendations.....	53
Key materials	53
Opportunities (interventions and actions)	53
References.....	55

Appendix A	MFA framework and scope	58
Appendix B	Stakeholder consultation	67
Appendix C	Information review	73
Appendix D	MCA outcomes	81
Appendix E	MFA outcomes	89

Figures

Figure 1	Resource flows in a circular economy (DELWP 2021).....	5
Figure 2	Geographic boundary of project scope	6
Figure 3	Estimated consumption by material category for region, 2021-22 (kt)	15
Figure 4	Projected consumption by material category for region, 2020-21 to 2029-30 (kt)	17
Figure 5	Estimated stocks by material category for region, 2021-22 (kt)	18
Figure 6	Estimated EoL generation by material category for region, by waste source stream (MSW, C&I, C&D), 2021-22 (kt)	19
Figure 7	Projected EoL generation by material category for region, 2020-21 to 2029-30 (kt).....	21
Figure 8	Estimated fate of each material category for region, 2021-22 (kt)	22
Figure 9	EoL generation of key material categories by source stream (MSW, C&I, C&D) by council, 2021-22 (kt)	27
Figure 10	EoL generation of key material types, by waste source stream (MSW, C&I, C&D), 2021-22 (kt).....	29
Figure 11	Fate of key materials by material category and council, 2021-22 (kt).....	31
Figure 12	Fate of key material types by council, by recovery and disposal groupings, 2021-22 (kt).....	33
Figure 13	EoL generation of key material types, by waste source stream (MSW, C&I, C&D) in Stonnington, 2021-22 (kt)	90
Figure 14	EoL generation of key material types, by waste source stream (MSW, C&I, C&D) in Boroondara, 2021-22 (kt).....	91
Figure 15	EoL generation of key material types, by waste source stream (MSW, C&I, C&D) in Glen Eira, 2021-22 (kt)	91
Figure 16	Fate of key material types in Stonnington, by recovery and disposal groupings, 2021-22 (kt).....	92
Figure 17	Fate of key material types in Boroondara, by recovery and disposal groupings, 2021-22 (kt).....	92
Figure 18	Fate of key material types in Glen Eira, by recovery and disposal groupings, 2021-22 (kt).....	93

Tables

Table 1	Material types in scope after screening.....	7
Table 2	MCA criteria screening materials.....	10
Table 3	Stakeholders for secondary phase of consultation.....	13
Table 4	Estimated consumption by material category for region, 2021-22 (kt)	16
Table 5	Projected consumption by material category, 2020-21 to 2029-30 (kt)	18

Table 6	Estimated stocks by material category for region 2021-22 (kt)	19
Table 7	Estimated EoL generation by material category for region, by waste source stream (MSW, C&I, C&D), 2021–22 (kt).....	20
Table 8	Projected EoL generation by material category for region, 2020–21 to 2029–2030 (kt).....	22
Table 9	Estimated fate of each material category for region, 2021–22 (kt)	23
Table 10	Material screening results	24
Table 11	EoL generation of key material categories by waste source stream (MSW, C&I, C&D) by council, 2021–22 (kt)	28
Table 12	EoL generation of the key materials by waste source stream (MSW, C&I, C&D) by council, 2021–22 (kt).....	30
Table 13	Summary of material flows, for each Council, 2021–22 (kt or %)	32
Table 14	Fate of the key materials by council, by recovery and disposal groupings, 2021–22 (kt).....	34
Table 15	Foundational interventions and recommended actions	38
Table 16	Highest ranked interventions and recommended actions by organics material types.....	41
Table 17	Ranked interventions and recommended actions by plastics material types.....	44
Table 18	Ranked interventions and recommended actions by paper and cardboard material types	46
Table 19	Ranked interventions and recommended actions by E-waste material types	48
Table 20	Ranked interventions and recommended actions by textiles material types	50
Table 21	Material categories and types	60
Table 22	Modelled application areas (as defined in the ‘use’ process)	61
Table 23	MFA system performance metrics.....	62
Table 24	Intervention list adopted for the project.....	63
Table 25	MCA scoring, environmental, waste to landfill.....	64
Table 26	MCA scoring, environmental, climate change	64
Table 27	MCA scoring, environmental/economic/social, state priority.....	65
Table 28	MCA scoring, environmental, waste hierarchy.....	65
Table 29	MCA scoring, social, employment.....	66
Table 30	MCA scoring, technical, delivery ease	66
Table 31	Regulations, policies and plans relevant to project.....	74
Table 32	Waste data sources for model.....	78
Table 33	Kerbside services in place for each council.....	79
Table 34	Demographic and economic overview for region in 2021.....	79
Table 35	Division level business numbers and full time employment (FTE), by council	80
Table 36	Top 20 interventions across all materials compared by Council	82
Table 37	Top 3 ranked interventions by material type (consistent by council)	86
Table 38	Summary of material flows, for Stonnington, 2021–22 (kt or %).....	94
Table 39	Summary of material flows, for Boroondara, 2021–22 (kt or %)	94
Table 40	Summary of material flows, for Glen Eira, 2021–22 (kt or %)	95

Abbreviations and glossary

C&I	Commercial and Industrial
C&D	Construction and demolition
EoL	End-of-life
FOGO	Food organics and garden organics together
FTE	Full-time equivalent
HDPE (2)	High density polyethylene (HDPE) (2)
LDPE (4)	Low density polyethylene (LDPE) (4)
LGA	Local Government Area
MCA	Multi-criteria analysis
MFA	Material flow analysis
MRF	Materials recovery facility
MSW	Municipal solid waste
MWRRG	The former Metropolitan Waste and Resource Recovery Group
OECD	Organisation for Economic Cooperation and Development
PET (1)	Polyethylene terephthalate (PET) (1)
PP (5)	Polypropylene (PP) (5)
PS (6)	Polystyrene (PS) (6)
PVC (3)	Polyvinyl chloride (PVC) (3)
SV	Sustainability Victoria
RV	Recycling Victoria

Summary

The transition to a circular economy requires systemic change across all sectors of the economy, with governments, businesses and communities playing a role. Cities are important because local governments can operate on a scale that enables quick decisions but are large enough to enable establishment of new circular functions and services. Cities also maintain infrastructure and services with circular potential. By characterising and analysing resource flows, a council can better understand its context and identify both needs and opportunities, and challenges to be addressed.

Materials flow analysis

This project assessed the flows of materials for three urban councils, the Cities of Stonnington, Boroondara and Glen Eira (the Councils). The full list of in-scope materials were organics, paper and cardboard, plastics, textiles, leather and rubber, glass, building and demolition materials, metals, tyres and the product e-waste. The materials flow analysis (MFA) outputs provide the quantitative data that gives context on the relative scales of the material flows and fates.

In this study waste data from local, state and national sources was used to inform the MFA and opportunity analysis. We relied on the Council provided municipal solid waste (MSW) tonnage data, for landfill and recycling collection and use the Councils' waste audits to estimate the splits of MSW across material types. Limitations exist for the data used in the MFA, especially in relation to commercial and industrial (C&I) and construction and demolition (C&D) wastes because council-level data was not available for these streams, and C&D waste is inherently difficult to predict. For these reasons best estimates were used for C&I and C&D waste data based on average state values, which were the most comprehensive dataset available, and were assumed representative of the region.

Consumption of all materials was estimated based on per capita allocations, as there was no other good quality data available to break down consumption by local government area (LGA). As such, estimates for consumption are approximations only, and do not account for any other variations across the geographic areas within the scope. The Councils should use the data with caution because of these limitations. Despite this lack of data, the modelling framework provides a foundation for future data analysis and provides indicative estimates to inform the Councils priorities and planning.

Key materials

A multi-criteria analysis (MCA) was used to identify key materials for avoidance or reduced use through Council action or influence. Based on quantity of waste to landfill, the potential greenhouse gas avoided by recovery and State priority, the five key materials for further assessment, ranking from first to fifth, were:

- organics
- paper and cardboard
- plastics
- textiles, leather and rubber
- e-waste

Opportunities (interventions and actions)

Within these five material categories, 16 material types were retained for analysis. A list of 17 interventions, developed with the Councils, were assessed using a MCA to identify the top ranked interventions for each material type. The interventions were grouped into seven streams which are:

- council policy and regulation
- council procurement
- council support
- data
- diversion of materials
- knowledge and capability building
- innovation, research and pilots.

The project identified thirty-one actions for the top three ranking interventions across the 16 material types. Six of these actions relate to four interventions which we identified as foundational for the Councils. They are:

Intervention	Intervention Stream
1. Integrate circular economy into council policies and strategies.	Council policy and regulation.
2. Create metrics and targets and track progress towards a circular economy.	Data.
3. Educate departments across LGAs on the principles of the circular economy.	Knowledge building and capability building.
4. Council communication program to demonstrate the paradigm shift to a circular economy.	Knowledge building and capability building.

The four foundational interventions apply irrespective of material type and for this reason, we recommend prioritising the foundational actions as essential activities.

The remaining 25 actions were spread across the five material categories with focus on specific material types, as informed by the MCA. The proposed action plans provide the Councils with priorities for each of the five materials, but noting the MCA was a filter only, specific projects/programs must be subject to their own detailed evaluation. The MCA was not exhaustive (e.g. it was constrained to the selected criteria), so other opportunities may arise that present high value to the Councils and these should be assessed on their own merits.

Circularity and benchmarking

Although the concept of a circular economy is not new, measurement of circularity could be described as in its infancy, with a lack of widely accepted, standardised measurement frameworks for circular economy yet in existence.

Except for Glen Eira Council, which has a recently formalised framework of circular economy indicators and metrics, the Councils are yet to determine circular metrics. Sustainability Victoria (SV) launched a draft circular economy measurement framework for Victoria in 2021. Our understanding is that SV and Recycling Victoria (RV) anticipate the framework will be released in early 2023 and intends to create a Victorian baseline report with localised information to enable use by councils.

This should provide a starting point for alignment across Victorian Councils, although broader comparison will remain challenging until there is National and ultimately global standardisation on frameworks and metrics.

In the absence of consistent, accepted indicators and metrics, and data, it was neither possible to measure the region or Councils circularity, nor was it possible to accurately benchmark against Australian and global cities. From a qualitative perspective we note the prevalence of regions and cities showing circular economy leadership is increasing in Australia. Examples of prominent actors include the Hunter Joint Organisation (Hunter Region) in NSW, Cities of Bendigo and Ballarat in regional Victoria and urban Councils with strong grassroots programs such as the City of Yarra.

We found the three Councils examined in this project have existing sustainability focussed strategies and plans which include varying levels of focus on circular economy, the most comprehensive being that of Glen Eira Council, which formalised its Circular economy plan in late 2022. The existing plans provide a strong foundation for each Council to build upon, using inputs such as this MFA and material analysis, in the journey towards a circular economy.

Recommendations

Based on this study we provide the following overarching recommendations to the Councils.

1. The four foundational interventions apply irrespective of material type and for this reason, we recommend prioritising the related actions as essential activities.
2. We recommend the Councils carefully consider fit for purpose circular economy metrics, include all parts of Council in the process, and collaborate across councils for shared learning. We also suggest the Councils align with the SV framework when it is released.
3. We recommend the Councils prioritise action on organics and plastics as the two highest ranked materials based on environmental, economic and social criteria.
4. Across the five material categories, we recommend the Councils use the proposed actions as a guide to prioritise resources and effort.

1. Introduction

1.1 Project objectives

The Councils commissioned Blue Environment in August 2022 to undertake a material flows analysis (MFA) and an assessment of circular economy opportunities for four materials in the urban region. During the project Blue Environment and the Councils expanded the assessment to five materials, through a formal scope change.

The Councils are committed to transitioning to a circular economy and benchmarking their level of circularity as well as identifying evidence based circular projects that will support the transition. Investigating the flows of materials to understand significant material sources is one aspect that councils can use to inform priorities and decisions on their circular journey.

The work conceptually mapped, and where possible, quantified the inputs and outputs from the businesses and industries within the region for in-scope materials. The project identified opportunities to reduce resource use, create jobs and keep materials at their highest value. The Councils are focussing on consumer-related consumption and small to medium-sized enterprises and intend to use the data to support business cases for bold ideas with significant impact.

The work informs priority opportunities in the short, medium and long term for the Councils to build a circular economy, with recommendations for the Councils to move forward considering implications of state and national policies and collaborative opportunities between the Councils.

1.2 Circular economy principles

Circular economy is a systems solution framework and central idea for solving big problems like climate change, waste and pollution. Underpinned by a transition to renewable energy and materials, a circular economy decouples economic activity from the consumption of finite resources. Principles central to a circular economy are the elimination of waste and pollution, circulation of products and materials at their highest value and regeneration of nature. A good definition of the circular economy is provided in a 2019 Victorian state government report (DELWP, 2019, p. 9):

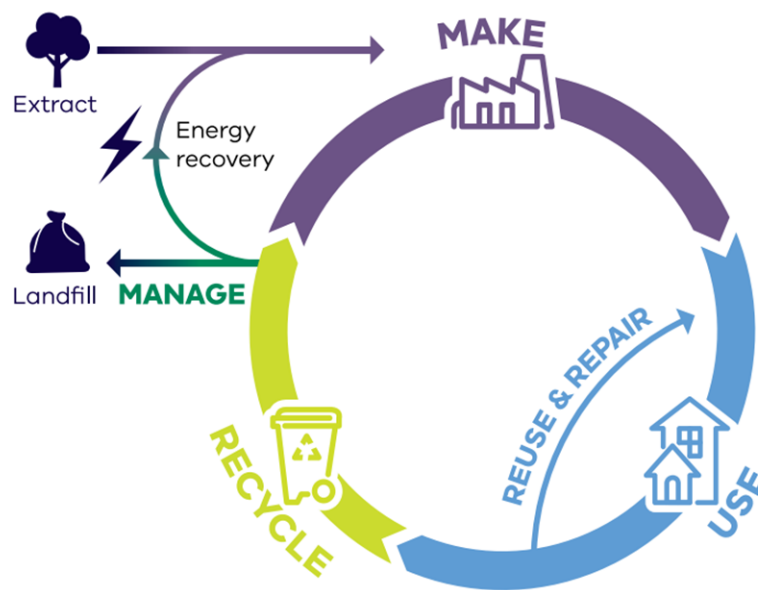
A circular economy continually seeks to reduce the environmental impacts of production and consumption, while enabling economic growth through more productive use of natural resources.

It allows us to avoid waste with good design and effective recovery of materials that can be reused. It promotes more efficient business models that encourage intense and efficient product use, such as sharing products between multiple users, or supplying a product as a service that includes maintenance, repair and disposal.

The value people obtain from the resources used to create goods and services increases. It transforms our linear economy mindset—take, use and throw away—and fosters innovation and productivity that invigorates existing businesses and creates new ones, delivering more jobs and more growth for local, regional, state and global economies.

See a visual representation of resource flows in a circular economy overleaf.

Figure 1 Resource flows in a circular economy (DELWP 2021)



1.3 Project scope

The project scope entailed:

1. An MFA of five materials, one of which is organics. The initial scope was an MFA of four materials. A fifth material is included for intervention analysis as part of a formal scope change agreed with the Councils.
2. Measurement of each council and the Region's circularity, depending on what is possible, and benchmarked against Australian and global cities.
3. For the five key materials, identification and analysis of opportunities for improving circularity based on:
 - a) 'low hanging fruit' for joint initiatives to recycle and reprocess waste
 - b) volumes and waste diversion potential
 - c) available reuse streams
 - d) the environmental benefits of improving material management, including carbon implications
 - e) retention at highest value
 - f) potential for job creation (noting this was not based on a formal economic analysis).
 - g) Identification of where the Councils could play an advocacy role and of other materials or products for future analysis.
4. Development of a roadmap for the Councils to drive a circular economy with options to progress the work and a prioritised action plan, considering policy settings, for each Council.

The geographic scope is Cities of Stonnington, Boroondara and Glen Eira and is provided in Figure 2.

Figure 2 Geographic boundary of project scope



Materials in scope

At a material category level (the most aggregated classification), options for the detailed MFA scope cover:

- organics
- paper and cardboard
- plastics
- textiles, leather and rubber
- glass
- building & demolition materials
- metals
- tyres
- e-waste.

Hazardous materials were outside the scope of this study and e-waste was included in the scope at the request of Councils following submission of the interim draft project report. The list of modelled material types is in Appendix A.

It is worth noting the difference between products and materials. Products such as cars, batteries, mattresses and furniture are comprised of multiple materials (e.g. metals, plastics, textiles, timber etc.) and hence are not modelled in the MFA. Products may be relevant, however, when considering specific key materials as this can inform the focus of potential actions.

Following screening (described in Section 1.4), at the category level, five materials remained in scope for intervention analysis:

- organics
- paper and cardboard
- plastics
- textiles, leather and rubber
- e-waste.

Presented in Table 1 are the material types in the categories that remained in scope. These material types and e-waste products are those set out in the Australian Standard for Waste and Resource Recovery Data and Reporting (Blue Environment, 2021).

Table 1 Material types in scope after screening

Type	Category
Food organics	Organics
Garden organics	Organics
Timber	Organics
Cardboard	Paper and cardboard
Polymer coated paperboard	Paper and cardboard
Office paper	Paper and cardboard
Newsprint & magazines	Paper and cardboard
PET (1)	Plastics
HDPE (2)	Plastics
PVC (3)	Plastics
LDPE (4)	Plastics
PP (5)	Plastics
PS (6)	Plastics
Textiles	Textiles, leather & rubber (excl. tyres)
Leather & rubber (excl. tyres)	Textiles, leather & rubber (excl. tyres)
E-waste	E-waste

Waste streams in scope

The waste streams included in the MFA are municipal solid waste (MSW), commercial and industrial (C&I) and construction and demolition (C&D) materials.

Further scope detail

A graphical summary of the overall MFA modelling, screening, intervention and action development is provided in Appendix A along with further detail on the MFA scope and scope list of interventions.

1.4 Project method

The method includes the following tasks:

- Task 1 - Project initiation
- Task 2 - Project plan (milestone 1)
- Task 3 - Information review
- Task 4 - Preliminary consultations
- Task 5 - Baseline data compilations
- Task 6 - Progress (Interim draft) report (milestone 2)
- Task 7 - Research and consultation program
- Task 8 - MFA model development (milestone 3)
- Task 9 - Development of opportunities, benchmarking report and draft roadmap (milestone 4)
- Task 10 - Draft project report (this report)
- Task 11 - Final project report (milestone 5) (this report)
- Task 12 – Presentation (completed during draft reporting task).

The approach and outcomes to stakeholder consultations is covered in Section 2 and Appendix B and the following sub-sections provide further detail on the method, covering three key aspects:

- information collection and other data (tasks 3, 4, 5, 7)
- MFA method (task 8)
- key material screening, intervention and action (opportunities) development (task 9).

Information collection and other data

Data collection involved a literature review of existing waste and material flows data, national, state and local regulations, policies and plans and circular economy best practices.

Waste data from local, state and national sources was used to inform the MFA and opportunity analysis. The waste data is used to calculate end-of-life (EoL) generation and fates, and estimate consumption in the region (described further in Section 3).

Economic data from the Australian Bureau of Statistics was used to inform primary business types in the region. Division level employment data by council identified the business types with highest number of employees in the region. This data was organised by the Australian and New Zealand Standard Industry Classification (ANZSIC).

The economic data enabled identification of businesses contributing more to employment or economic output in each council. Information on commercial waste composition, hospitality and retail (First Person Consulting 2021) and by ANZSIC classification (SRU 2013) was used for insight about potential waste materials generated by the primary business types in the region. This data was integrated into development of potential actions.

MFA method

The regional flows analysis was based on a material flow analysis (MFA) for in scope materials, along with collation of other data in relation to policies, plans and the environment impacts of materials.

This information was then used to inform a preliminary multi-criteria analysis (MCA) to screen the materials and confirm five key materials for further analysis. The information also informed a full MCA to rank a set of interventions against each material type. The MFA and two-stage MCAs are in a Microsoft Excel model to accompany the final report.

The MFA estimated consumption, EoL generation and fates (recycling / landfill / other) of the materials in the 2021–22 financial year. In addition, the MFA estimated consumption, stocks and EoL generation across the period of 2000–01 to 2029–30.

There were two main uses of the MFA outputs. The first was to provide the quantitative data that gives context on the relative scales of material flows and fates (reported in Section 3). The second use was to inform the MCA criteria scoring for the climate change and waste to landfill criteria. See Table 2 for more on the proposed MCA criteria.

Screening and intervention analysis method

An MCA compares quantitative and qualitative impacts across proposals for action (or ‘interventions’ here) by assigning scores to criteria linked to the likely impacts of the intervention. Infrastructure Australia (IA, 2021, p. 6) defines MCA as follows:

Multi-criteria analysis (MCA) is a tool that can be used to compare reform and investment proposals. When applied consistently and transparently, it is a suitable approach for filtering options before applying more detailed quantitative analysis, or to compare options where impacts are not easily quantifiable. MCA uses objectives, criteria, measures, weightings and scoring approaches to rank and compare options.

Although a degree of subjectivity is inherent in the MCA approach, when applied appropriately, MCA can provide a structured, systematic and transparent framework for comparing options with some non-quantified costs and/or benefits.

There were six criteria, as confirmed with Councils, for this project, which are summarised in the following Table 2. As described in Section 4.1 three criteria in the MCA were used to screen the materials and confirm the five key materials for further analysis (noting the Councils specified that organics must be selected). All six criteria were used to assess the interventions.

Table 2 MCA criteria screening materials

Criterion	Criterion group	Description	Scoring method	Applied to
Waste to landfill	Environmental performance	Anticipated quantities of waste to landfill with the associated legacy issues of waste management and potential future releases to the environment.	Quantitative – 1–5 score based on the quantity to landfill quintile.	Screening Intervention analysis
Climate change	Environmental performance	Emissions of greenhouse gases known to contribute to climate change. The potential GHG avoided by recovery.	Quantitative – 1–5 score based on the 'avoidable emissions if recycled' quintile.	Screening Intervention analysis
State priority	Environmental, social and economic performance	This criterion considers whether the material is a SV priority, the existing level and success of interventions and future priority potential	Qualitative – 1–5 score based on qualitative descriptors to convert to a numerical scale so that numerical operations can be performed.	Screening Intervention analysis
Waste hierarchy	Environmental performance	This criterion assesses the position of the program/project on the waste hierarchy, in relation to the end-market of the majority of the material that is impacted.	Qualitative – 1–5 score based on qualitative descriptors to convert to a numerical scale so that numerical operations can be performed.	Intervention analysis
Employment	Economic and social performance	This criterion considers direct and indirect job creation or loss.	Qualitative – 1–5 score based on qualitative descriptors to convert to a numerical scale so that numerical operations can be performed.	Intervention analysis
Delivery ease	Technical performance	This criterion considers how hard an intervention is to deliver.	Qualitative – 1–5 score based on qualitative descriptors to convert to a numerical scale so that numerical operations can be performed.	Intervention analysis

Following the MCA assessment of interventions, separately for each in-scope material type, the top three ranked interventions had at least one proposed action developed for consideration. The actions were informed based on Blue Environment staff knowledge and experience and the research conducted for this project. They were not determined through the MCA so are more subjective in nature.

Interventions were general by nature to enable consistent assessment using the MCA. The actions developed against interventions were more specific and localised to each Councils' context.

It is important to note that the MCA should be seen as a filter only, and not as a tool for definitively selecting specific projects or programs. Specific projects/programs, whether based on the guidance provided by this project or not, should be subject to their own detailed evaluation.

1.5 Limitations and assumptions

This section provides the limitations for data used in the MFA modelling as well as the key assumptions used.

Consumption of all materials was estimated based on per capita allocations, as there was no other good quality data available to break down consumption by local government area (LGA). As such, estimates for consumption are approximations only, and do not account for any other variations across the geographic areas within the scope.

Waste data from local, state and national sources was used to inform the MFA and opportunity analysis. We relied on the council-provided MSW tonnage data for landfill and recycling collection and used the Councils' waste audits to estimate the splits of MSW across material types.

For the model to identify certain datapoints, some terms may appear slightly differently than initially provided by council, based on subsequent clarifying questions. For example, when waste to landfill from a transfer station is dropped off it sits under the 'Drop-off garbage' category. In some cases, transfer station data did not separate drop-off garden organics from other recyclables. As such, the 'Drop off recycling' category contains commingled and organic materials. Similarly, garbage to landfill from municipal services (like street sweepings, public bins) for some councils was included in transfer station data. A summary of this input data was provided to each council, concurrent with provision of the Interim project report, for confirmation.

Limitations exist for the data used in the MFA, especially in relation to C&I and C&D because council-level data was not available for these streams, and C&D waste is inherently difficult to predict. For these reasons best estimates were used for C&I and C&D waste tonnage data based on average state values, which were the most comprehensive dataset available and were assumed representative of the region. The region's proportional split of industrial waste to landfill into C&I and C&D streams is identical to the state average. The rate of generation and recycling of C&I and C&D waste per capita is assumed to be identical to the state average.

In the tables presented in this report, minor discrepancies may occur between the stated summed totals and the apparent sums of the contributing values, as summed totals and percentage values were calculated using contributing values prior to rounding.

We were unable to confidently present error ranges for the data because there was not enough data to allow those to be estimated. Councils should use the data with caution because of these limitations.

2. Stakeholder consultation

The project engaged with stakeholders in two phases. The first phase was preliminary consultation (Task 4) to further our understanding of the project context and opportunities. Secondary consultation (part of research and consultation Task 7) was used to obtain informed views from industry stakeholders about what could be done to improve circularity of materials.

2.1 Preliminary consultations

During preliminary consultations, we discussed available data, explored secondary methods to fill data gaps, circular economy benchmarking and key stakeholders for secondary consultation.

Interviewed stakeholders were:

- Recycling Victoria
- Sustainability Victoria
- Rawtec
- Stonnington, Boroondara and Glen Eira Councils.

Consultation with Councils determined that while MSW local government area data is available, no datasets are collected for C&I or C&D. Discussion with Recycling Victoria identified no other council area data for C&I and C&D tonnage and composition. Aggregated state datasets were used to create proportional estimates based on population data to populate non-MSW waste quantities and composition for the respective council areas.

Usable pre-existing consumption data was not identified during consultations for local government areas, and national consumption data was also not suitable. To resolve this data gap, we derived consumption to waste generation ratios from the National Waste Report (Blue Environment, 2020) for each material type.

2.2 Secondary consultation

Using the information obtained in preliminary consultations, Blue Environment established a short-list of stakeholders to contact as part of the secondary phase. The stakeholders and purpose of consultation are identified in Table 3 below. The council location of each stakeholder is denoted as follows: (S) Stonnington, (B) Boroondara and (GE) Glen Eira.

Further details on stakeholders, and key takeaways from each session are outlined in Appendix B.

Table 3 Stakeholders for secondary phase of consultation

Type of stakeholder	Stakeholder	Purpose
Major generators of waste	Caufield Hospital (GE)	Understand waste types, generation, management, and challenges and opportunities for circular economy.
	Chadstone shopping centre (S)	
	Thomas Damm Catering (GE)	
Regional commerce group	Carnegie Traders Association (GE)	Understand waste trends and challenges unique to the association, level of involvement in local circular economy initiatives and opportunities for increasing circular economy.
	Glenferrie Traders Association (B)	
Waste managers	Cleanaway (S)	As a local waste services provider, to understand local waste management, facility capacities, challenges with managing materials and opportunities for increasing recovery.
	Re.Group (formerly Polytrade) (GE)	
	Biogro (S) (B)	
Academia (and major generators of waste)	Monash University (GE)	Local academic institution, key knowledge of circular economy implementation, organics collection for Swinburne.
	Swinburne University (B)	

2.3 Key takeaways

While each consultation was specific to the type of stakeholder and organisation, there emerged common challenges and opportunities for circular economy in a local context. These are listed below, and where possible talk to specific materials.

Challenges

Preliminary consultations highlighted the limited availability of reliable state C&I and C&D data on waste consumption, generation and recycling. State agencies use proportional population data, and this was the method employed by Blue Environment to calculate these figures. Further, limited circular economy metrics have been developed nationally.

Secondary consultations spoke to challenges specific to the urban council's region. A lack of education amongst traders causes high contamination rates and overflowing bins. Many businesses have only a garbage bin and very few have an organics bin and there are currently limited recycling opportunities for commercial properties. Due to the location, there is limited space available for garbage bins which are often situated in laneways. This causes bad odour, issues with rodents and further exhausts space allocations. Language barriers also exist in the region.

A major challenge for commercial and household waste recovery is contamination. Contamination in commingled recycling bins results in lower recovery rates, causes mechanical issues at the material recovery facility (MRF), and results in additional time and financial imposts. Soiled paper and cardboard contamination is a particular problematic material raised in consultations. Contamination is often heightened around holiday seasons.

Opportunities

Using their diverse experience and expertise, interviewed stakeholders provided many suggestions on how to increase circular economy within the region. Significant opportunities were:

- council procurement of recycled material and incentives for purchasing recycled material/products
- develop methods to monitor waste composition, streams and destinations
- facilitate business-to-business circular opportunities by identifying if a waste output can be an input for another business
- free cardboard collection for traders' association members
- implement soft plastics collection through kerbside recycling bins
- include sustainability and circular economy aspects within development applications to persuade executives of its importance
- assist larger organisations by sharing research, knowledge building and educational tools
- work with educational institutions in the region to develop circular economy initiatives and trials.

Consultations informed opportunities for council to increase knowledge of the circular economy concept by creating awareness of existing opportunities within council and sharing local circular economy success stories.

Some stakeholders raised opportunities to address challenges raised in the previous section. To address the limited kerbside space for presenting bins for pick-up, Councils could alternate collection days for different services, or commercial businesses could share bins. To address contamination, Councils could develop educational material to inform what is and is not accepted in commingled recycling bins, potentially as a QR code with a short guide or an 'A-Z of accepted materials'.

Organics were of particular interest to stakeholders. They suggested council buy back compost from organics collections, and encourage residents to do the same. To improve collection of food organics and garden organics (FOGO), Councils should ensure caddies and liners are compliant and should provide simple instructions to households. Stakeholders were interested in FOGO for commercial properties as part of council offerings. Consultation with waste managers suggested council work with organics reprocessors to set up commercial FOGO configurations, and implement organic product into community spaces.

Most stakeholders expressed a strong interest in participating in council circular economy initiatives and pilot programs, including:

- Alfred Caulfield Hospital
- Biogro
- Chadstone shopping centre
- Cleanaway
- Monash university
- Re.Group
- Swinburne University
- Thomas Damm Catering.

3. Materials flow analysis

Provided in this section is contextual information on consumption (new products and materials in use), stocks (materials in use), EoL generation, and fates (landfill, recycling, other) presented by material category. The data is aggregated for the region for the purpose of selecting the key materials for further analysis and action planning in Sections 4 and 5.

3.1 Consumption

Due to the unavailability of local consumption data, consumption to waste generation ratios derived from national waste data were used in the MFA. The consumption level data has relatively high uncertainties but is useful to provide an indication of the relative quantities consumed.

Although the data available for this project has increased uncertainty at the local level, the results still clearly demonstrate the relative difference in quantity of materials estimated to be consumed across the in-scope categories. As shown in Figure 3 and Table 4, quantities of building and demolition material are more than double organics, which is the next highest quantity of consumed material.

Figure 3 Estimated consumption by material category for region, 2021-22 (kt)

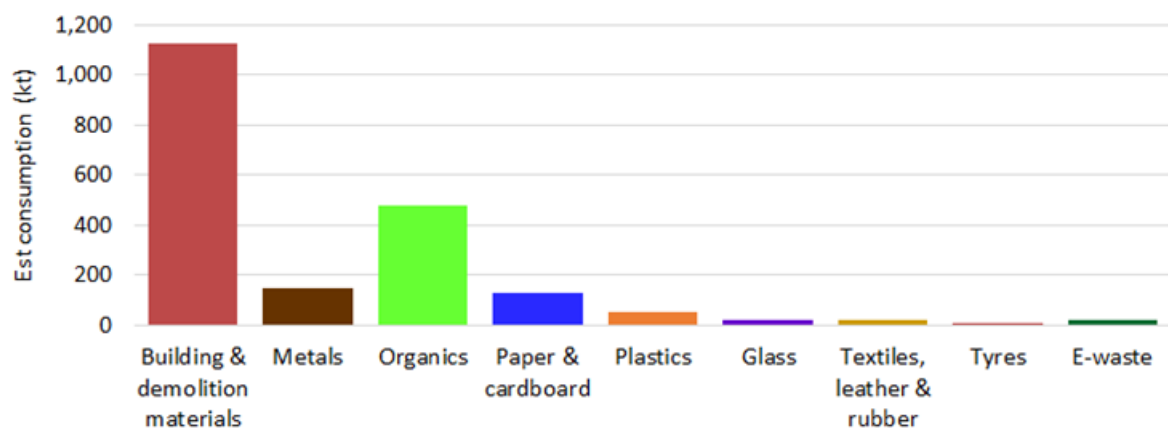


Table 4 *Estimated consumption by material category for region, 2021-22 (kt)*

Material category	Regional consumption
Building & demolition materials	1,123
Metals	149
Organics	477
Paper & cardboard	128
Plastics	54
Glass	20
Textiles, leather & rubber	21
Tyres	7
E-waste	19
Total	1,998

Project consumption from 2020–21 to 2029–30 is shown in Figure 4 and Table 5. Building and demolition materials have been omitted from the chart to enable visibility of the lower quantity materials. The quantities for all in-scope material categories are presented in Table 5.

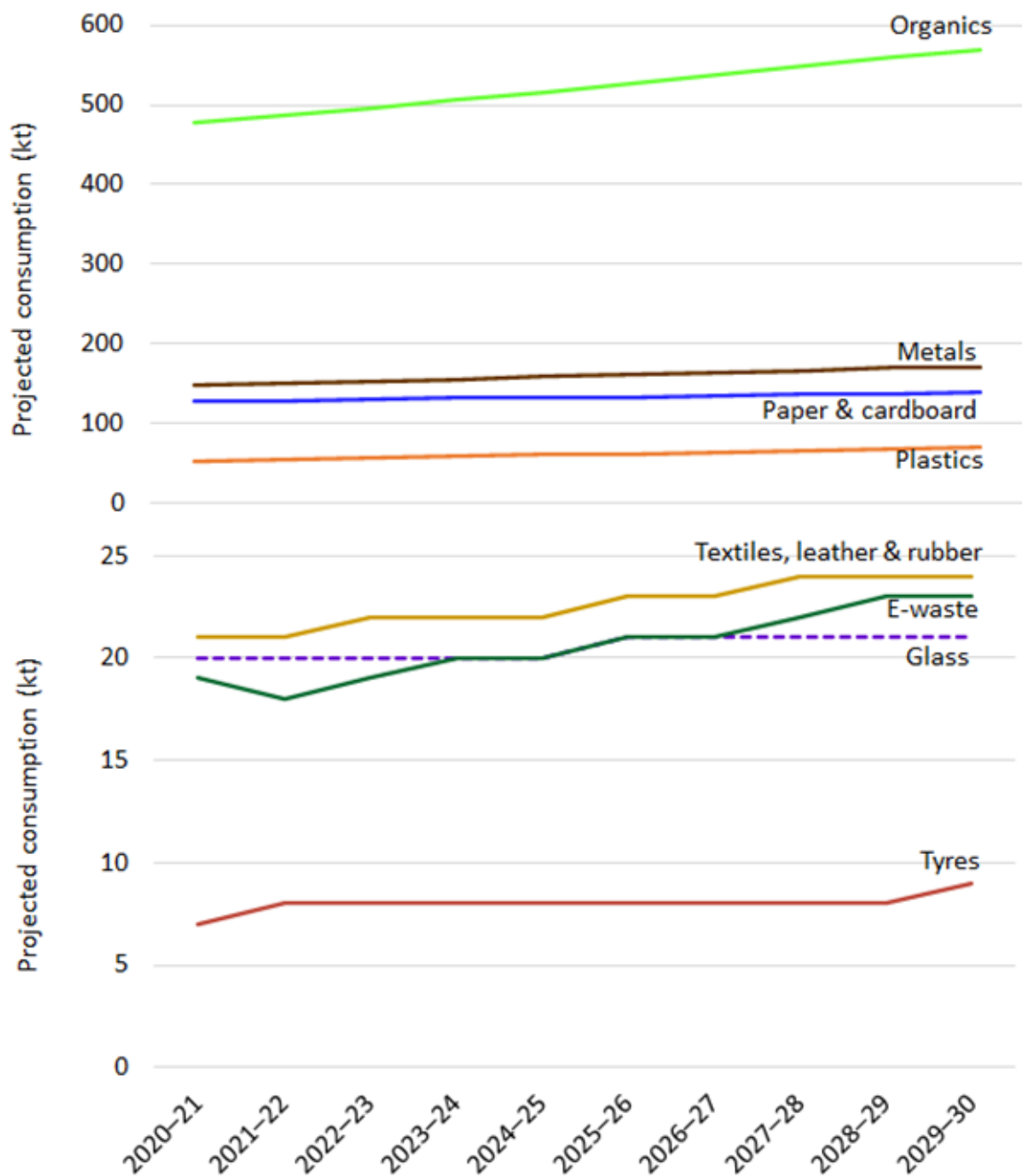
Due to the unavailability of regionally specific forecasts in consumption of each material, projected consumption was calculated using consumption ratios generated from the available national and state level MFA data (Blue Environment 2022c).

Figure 4 presents projected growth in consumption for each material category to 2029–30. The anticipated growth in organics, e-waste and textiles are the highest. There is only modest growth in the consumption of metals and paper/cardboard anticipated.

The underlying rates of increase in consumption as calculated in the national and state level datasets (Blue Environment 2022c), with the exceptions of e-waste, glass and 'textiles, leather & rubber', are mostly based on either per capita or CPI annual projected growth rates due to the lack of other more material specific information on future growth rates. It is important to note that this gives the appearance of organics growing faster than most other material types, due to the high starting (baseline) value. So the strong increase in organics consumption should be interpreted with caution.

The growth in consumption of e-waste, glass and 'textiles, leather & rubber' is based on more material specific growth rates in the underlying MFA modelling, which are generally higher than either per capita or CPI growth projections.

Figure 4 Projected consumption by material category for region, 2020-21 to 2029-30 (kt)



Note that the y-axis scale differs between the two charts above due to the significant disparity in quantities, with textiles, leather and rubber, e-waste, glass and tyres less than 25 kt for the duration. Glass is represented with a dotted line to enhance visibility due to the overlap with e-waste quantities.

Table 5 Projected consumption by material category, 2020-21 to 2029-30 (kt)

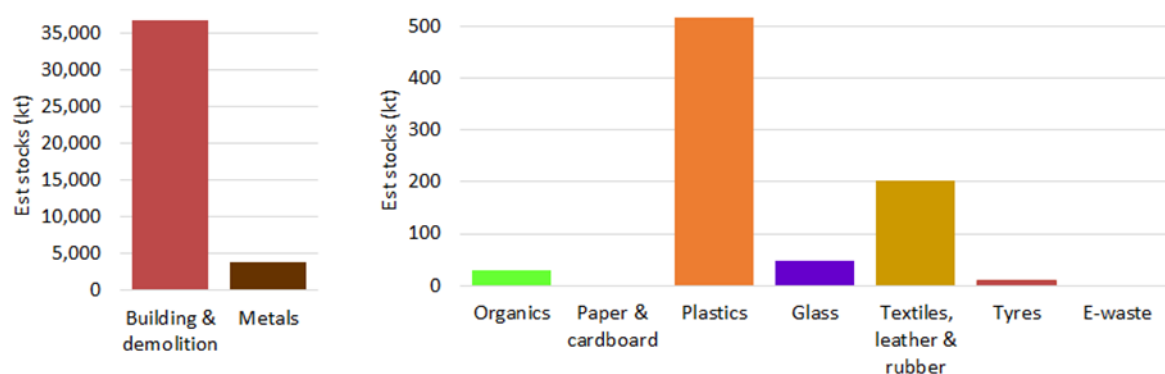
Material category	Consumption									
Year	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30
Building & demolition materials	1,123	1,140	1,157	1,174	1,192	1,210	1,229	1,249	1,269	1,289
Metals	149	151	154	156	159	162	164	167	170	172
Organics	477	486	496	506	516	526	537	548	559	570
Paper & cardboard	128	129	130	132	133	134	135	137	138	139
Plastics	54	56	57	59	61	63	65	67	69	71
Glass	20	20	20	20	20	21	21	21	21	21
Textiles, leather & rubber	21	21	22	22	22	23	23	24	24	24
Tyres	7	8	8	8	8	8	8	8	8	9
E-waste	19	18	19	20	20	21	21	22	23	23
Total	1,998	2,029	2,063	2,097	2,131	2,168	2,203	2,243	2,281	2,318

3.2 Stocks

A stock is an aggregation of materials in a process or in use. For example, a car in use contains a variety of materials and these must be accounted for within the material flow model. The estimated stocks for in-scope materials in the region are presented in Figure 5 and Table 5. Due to the significant difference in quantities, building and demolition and metals are presented separately.

For the same reason as outlined in relation to consumption, the stocks were not applicable or could not be estimated for all material types (including garden organics, timber, sawdust, biosolids, other organics). The stocks data for e-waste have not been estimated. Cardboard and paper has a lifespan of less than one year and therefore was not quantified as a stock.

Figure 5 Estimated stocks by material category for region, 2021-22 (kt)



Note the y-axis scale differs between the two charts in Figure 5. The scale on the chart showing organics and plastics etc. is seven times smaller, only up to 500 kt stocks for plastics as compared to 35,000 kt stocks for building and demolition materials, which are high due to the longevity of buildings and structures.

Table 6 Estimated stocks by material category for region 2021-22 (kt)

Material category	Regional stocks
Building & demolition materials	36,746
Metals	3,846
Organics	30
Paper & cardboard	N/a
Plastics	517
Glass	47
Textiles, leather & rubber	202
Tyres	9
E-waste	0
Total	41,397

3.3 End of life generation

For the State and nation, EoL generation data is important to inform required reprocessing capacity. Presented in Figure 6 and Table 7 show the estimated generation by material category. Building and demolition has been removed from Figure 6 to enable visibility of other material categories that are generated in much lower quantities. The next highest quantity generated is organics with 50% coming from the C&I waste stream.

Figure 6 Estimated EoL generation by material category for region, by waste source stream (MSW, C&I, C&D), 2021-22 (kt)

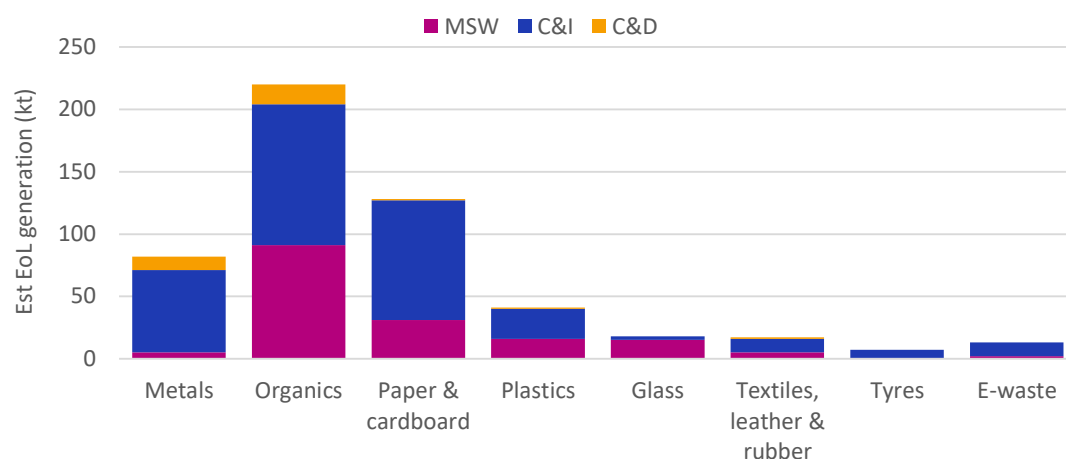
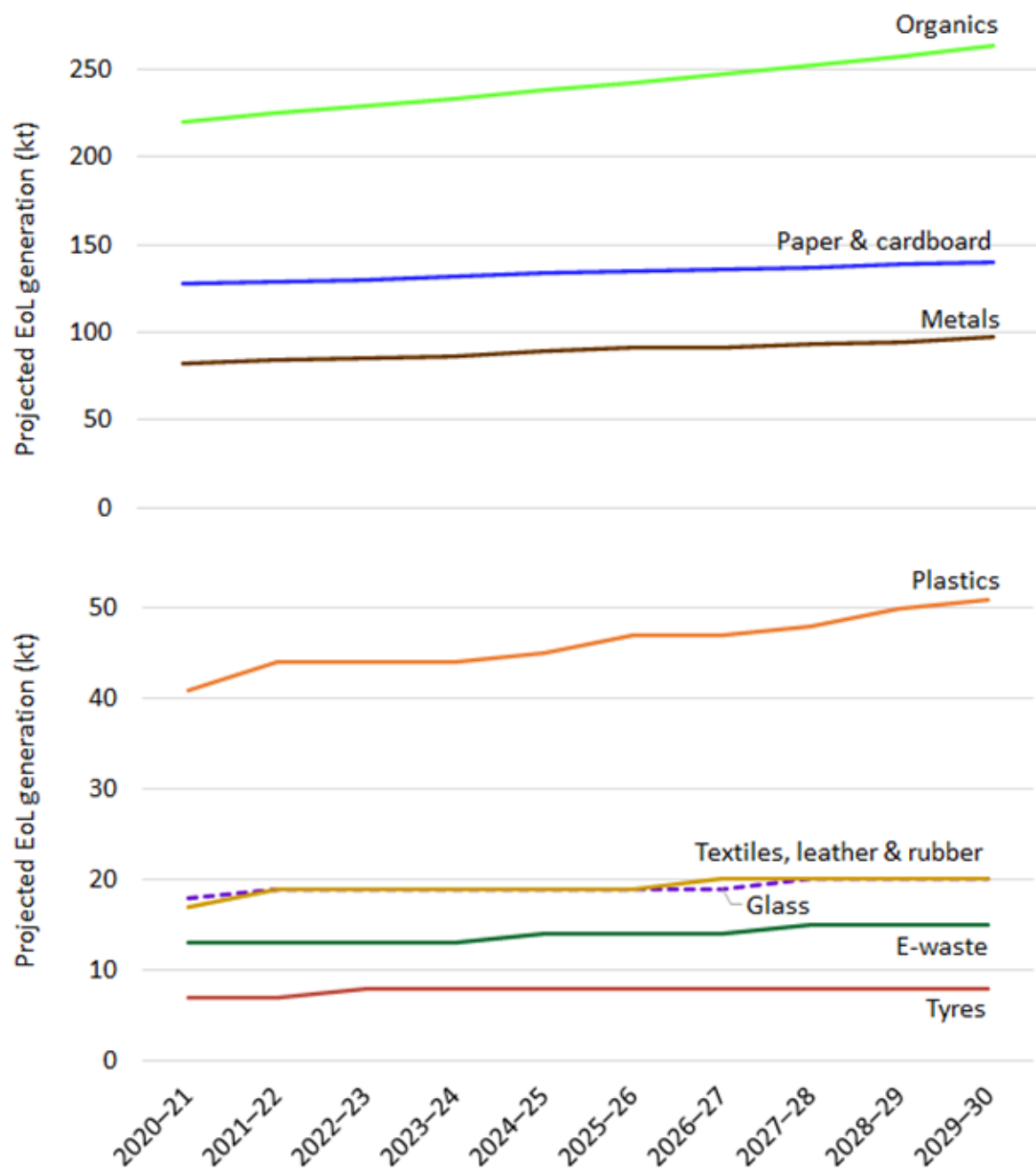


Table 7 *Estimated EoL generation by material category for region, by waste source stream (MSW, C&I, C&D), 2021–22 (kt)*

Material category	MSW	C&I	C&D	Total
Building & demolition materials	2	27	459	488
Metals	5	66	11	82
Organics	91	113	16	220
Paper & cardboard	31	96	1	128
Plastics	16	24	1	41
Glass	15	3	0	18
Textiles, leather & rubber	5	11	1	17
Tyres	0	7	0	7
E-waste	2	11	0	13
Total	167	358	489	1,014

Projected EoL generation is shown in Figure 7 and Table 8. Building and demolition has again been removed from the chart to enable visibility of other material categories that are generated in much lower quantities.

Figure 7 Projected EoL generation by material category for region, 2020–21 to 2029–30 (kt)



Note that the y-axis scale differs between the two charts to show the materials with lower quantities of generation, plastics, textiles, glass, e-waste and tyres clearly.

Table 8 Projected EoL generation by material category for region, 2020–21 to 2029–2030 (kt)

Material category	EoL									
Year	2020–21	2021–22	2022–23	2023–24	2024–25	2025–26	2026–27	2027–28	2028–29	2029–30
Building & demolition materials	488	498	508	518	529	539	550	561	573	585
Metals	82	84	85	86	89	91	92	94	95	98
Organics	220	225	229	233	239	243	248	253	258	264
Paper & cardboard	128	129	130	132	134	135	136	137	139	140
Plastics	41	44	44	44	45	47	47	48	50	51
Glass	18	19	19	19	19	19	19	20	20	20
Textiles, leather & rubber	17	19	19	19	19	19	20	20	20	20
Tyres	7	7	8	8	8	8	8	8	8	8
E-waste	13	13	13	13	14	14	14	15	15	15
Total	1,014	1,038	1,055	1,072	1,096	1,115	1,134	1,156	1,178	1,201

3.4 Fates

The fate data shows where materials end up. In this project, the data is sufficient to estimate fates of landfill and recycling, plus an additional ‘other’ fate for some stockpiled biosolids (part of C&I organics).

Fate data is important to understand the type and quantity of materials that end up in landfill as compared to materials estimated to be recycled. The estimated fates by material category are provided in Figure 8 and Table 9. Although the data available for this project had high uncertainty the results show the relative difference in quantity of materials. Building and demolition materials and metals are recycled around 85%, paper and cardboard at 70% and recycled organics are estimated at around 50% with plastics below 25%. The fate of selected materials is examined more closely in sub-section 4.2 for the selected key materials.

Figure 8 Estimated fate of each material category for region, 2021–22 (kt)

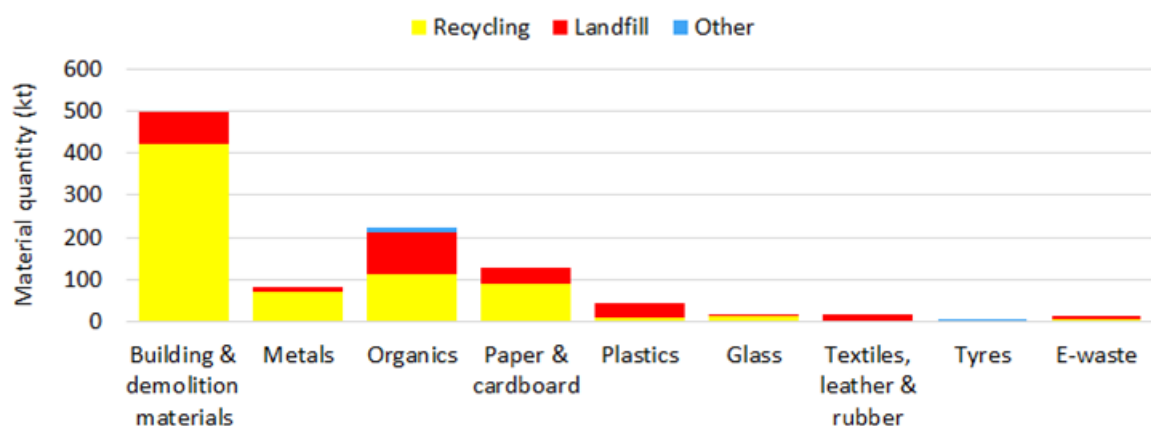


Table 9 *Estimated fate of each material category for region, 2021–22 (kt)*

Material category	Recycling	Landfill	Other	Total
Building & demolition materials	423	75	0	499
Metals	72	11	0	84
Organics	114	100	11	225
Paper & cardboard	91	38	0	129
Plastics	11	34	0	44
Glass	12	7	0	19
Textiles, leather & rubber	3	15	0	18
Tyres	2	2	3	7
E-waste	7	6	0	13
Total	735	288	15	1,038

4. Key materials

4.1 Key materials selection

This section provides the results of the MCA assessment. The MCA scores for waste to landfill and climate change were calculated via the MFA. A higher score was calculated for those material types that had a larger quantity of waste ending up in landfill. Similarly, those material types that, if diverted, will avoid the highest greenhouse gas emissions, got a higher climate change score.

The scores by material type provide an indication where to focus with LDPE (4) ranking first, followed by food organics and garden organics equal second. To select materials for more detailed analysis it was necessary to aggregate by category with the results provided in the table below. At this point several material types are removed due to either lack of significant intervention level actions for local governments (sawdust, biosolids) or material types too broad to be meaningful (e.g. other organics, other plastics). The five materials ranked highest for further analysis' were organics, plastics, paper and cardboard, e-waste and textiles as shown in Table 10.

Table 10 Material screening results

Material type	Material category	MCA screening criteria			Rank at material type	Aggregated ranking
		Waste to landfill	Climate change	State priority		
Asphalt	Building & demolition materials	3	2	2	25	Eighth (Equal)
Bricks, concrete & pavers	Building & demolition materials	5	2	2	19	
Ceramics, tiles & pottery	Building & demolition materials	4	2	2	21	
Plasterboard & cement sheeting	Building & demolition materials	3	1	2	26	
Soil, sand and rock	Building & demolition materials	1	1	1	32	
Rubble	Building & demolition materials	4	3	2	19	Eighth (Equal)
Iron and steel	Metals	4	4	1	16	
Aluminium	Metals	2	5	1	21	
Non-ferrous metals (ex. aluminium)	Metals	1	2	1	29	

Material type	Material category	MCA screening criteria			Rank at material type	Aggregated ranking
Food organics	Organics	5	5	4	2	First
Garden organics	Organics	5	5	4	2	
Timber	Organics	5	5	2	8	
Sawdust	Organics	4	4	2	12	
Biosolids (non-contaminated)	Organics	1	1	2	29	
Other organics	Organics	1	1	2	29	
Cardboard	Paper & cardboard	5	4	3	6	Third
Polymer coated paperboard	Paper & cardboard	2	1	3	26	
Newsprint & magazines	Paper & cardboard	4	4	3	9	
Office paper	Paper & cardboard	4	5	3	6	
PET (1)	Plastics	3	5	5	4	Second
HDPE (2)	Plastics	2	3	5	12	
PVC (3)	Plastics	1	2	5	21	
LDPE (4)	Plastics	5	5	5	1	
PP (5)	Plastics	3	3	5	9	
PS (6)	Plastics	2	2	5	16	
Other plastics (7)	Plastics	3	3	5	9	
Glass from food & beverage containers	Glass	3	4	3	12	Sixth (equal)
Other glass	Glass	2	3	3	21	
Textiles	Textiles, leather & rubber	5	4	4	4	Fifth
Leather & rubber (excl. tyres)	Textiles, leather & rubber	1	1	4	26	
Tyres (T140)	Tyres	2	3	4	16	Sixth (equal)
E-waste	E-waste	3	3	4	12	Fourth

4.2 Key material summary

Provided in this section is contextual information on EoL generation, and fates (landfill, recycling) by material category and type for the five key materials. The data is provided at Council level for the purpose of further analysis and action planning.

Note from this point on, the scope of the key material categories was limited to those material types believed meaningful for action planning, as for the reasons described in Section 4.1. The result is a lower quantity of materials for organics and plastics than in Section 3 following removal of selected types such as 'other organics', 'other plastics' etc.

End of life generation

The three Councils had a similar profile for estimated generation for in-scope materials by type, noting Boroondara and Glen Eira Councils have a higher population than Stonnington Council.

For the in-scope materials, the C&I stream generates the largest quantity of material for each council (Figure 9 and Table 11), which validates the focus on businesses for circular economy opportunities. Waste data from State sources is used to estimate C&I so the differences observed between councils for this stream are due to the differing populations.

Figure 9 EoL generation of key material categories by source stream (MSW, C&I, C&D) by council, 2021–22 (kt)

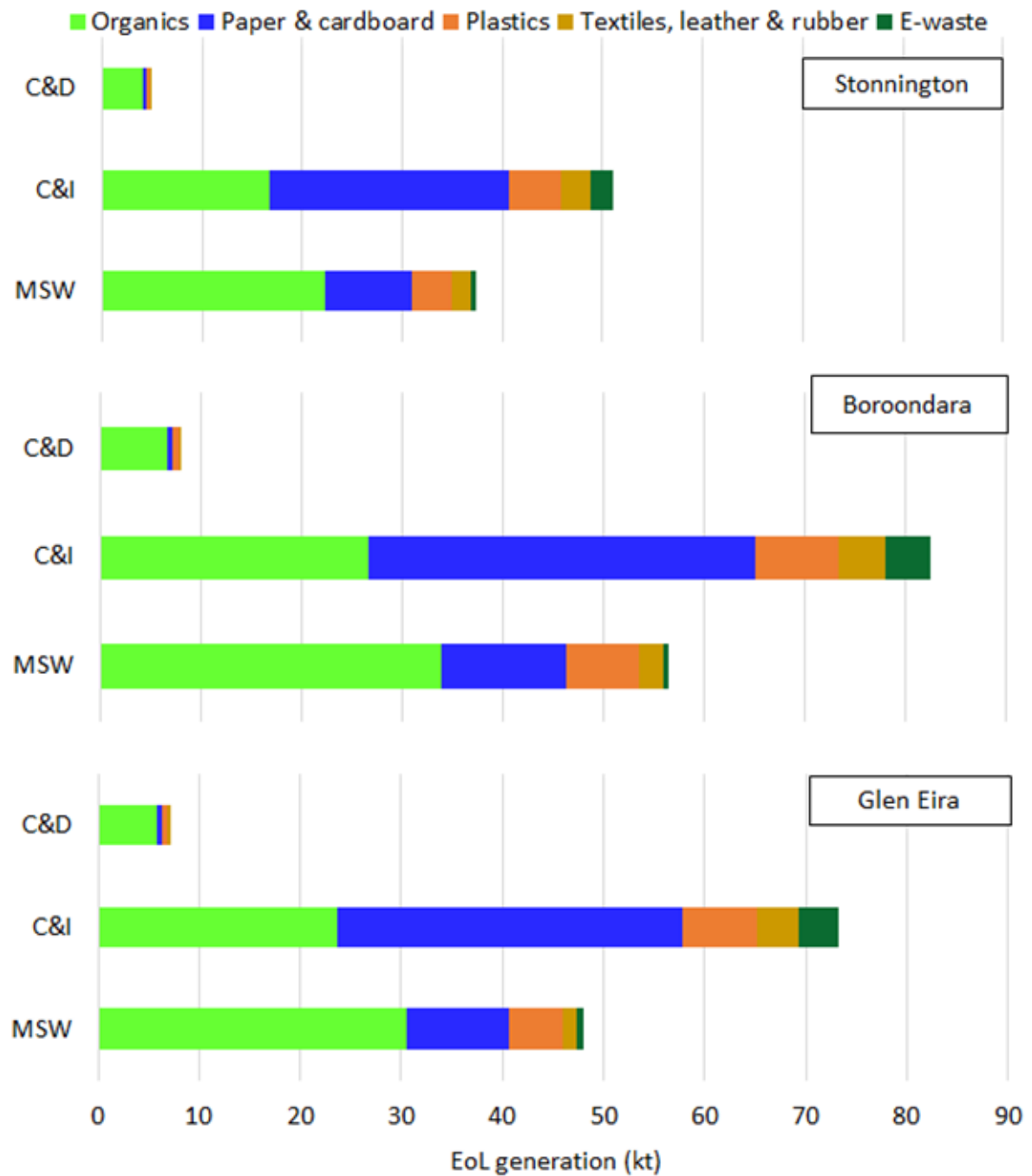


Table 11 *EoL generation of key material categories by waste source stream (MSW, C&I, C&D) by council, 2021–22 (kt)*

	Material category	MSW	C&I	C&D	Total
Stonnington	Organics	22.2	16.7	4.1	43.0
	Paper & cardboard	8.7	24.1	0.4	33.1
	Plastics	4.1	5.2	0.4	9.6
	Textiles, leather & rubber	1.8	2.9	0.2	4.9
	E-waste	0.5	2.3	0.0	2.8
	Total	37.3	51.1	5.0	93.5
Boroondara	Organics	34.0	26.7	6.6	67.2
	Paper & cardboard	12.3	38.5	0.6	51.3
	Plastics	7.3	8.3	0.6	16.2
	Textiles, leather & rubber	2.4	4.6	0.3	7.3
	E-waste	0.6	4.5	0.0	5.0
	Total	56.6	82.5	8.1	147.1
Glen Eira	Organics	30.6	23.6	5.9	60.1
	Paper & cardboard	10.1	34.1	0.5	44.7
	Plastics	5.3	7.4	0.5	13.2
	Textiles, leather & rubber	1.3	4.1	0.3	5.7
	E-waste	0.7	4.0	0.0	4.7
	Total	48.0	73.2	7.2	128.3

Presentation of materials by type as shown in Figure 10 and Table 12 provides an indication of variation within a category. The paper and cardboard category, for example, is dominated by cardboard from the commercial sector. For plastics there is a difference in estimated quantity across the polymer types with 15.5 kt LDPE the highest and 1.0 kt PVC the lowest quantity.

Figure 10 is presented separately for each council in Appendix E.

Figure 10 EoL generation of key material types, by waste source stream (MSW, C&I, C&D), 2021-22 (kt)

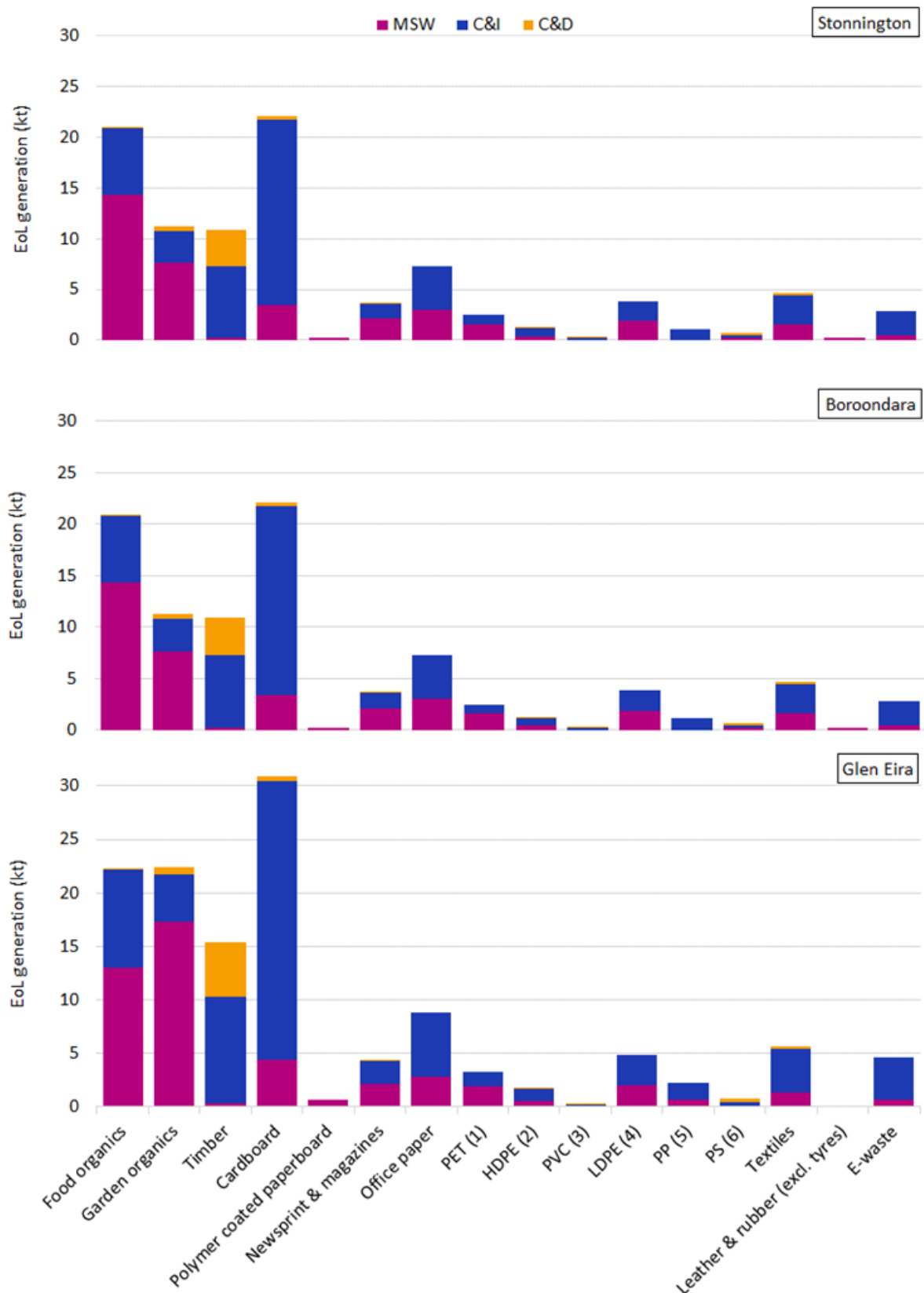


Table 12 *EoL generation of the key materials by waste source stream (MSW, C&I, C&D) by council, 2021–22 (kt)*

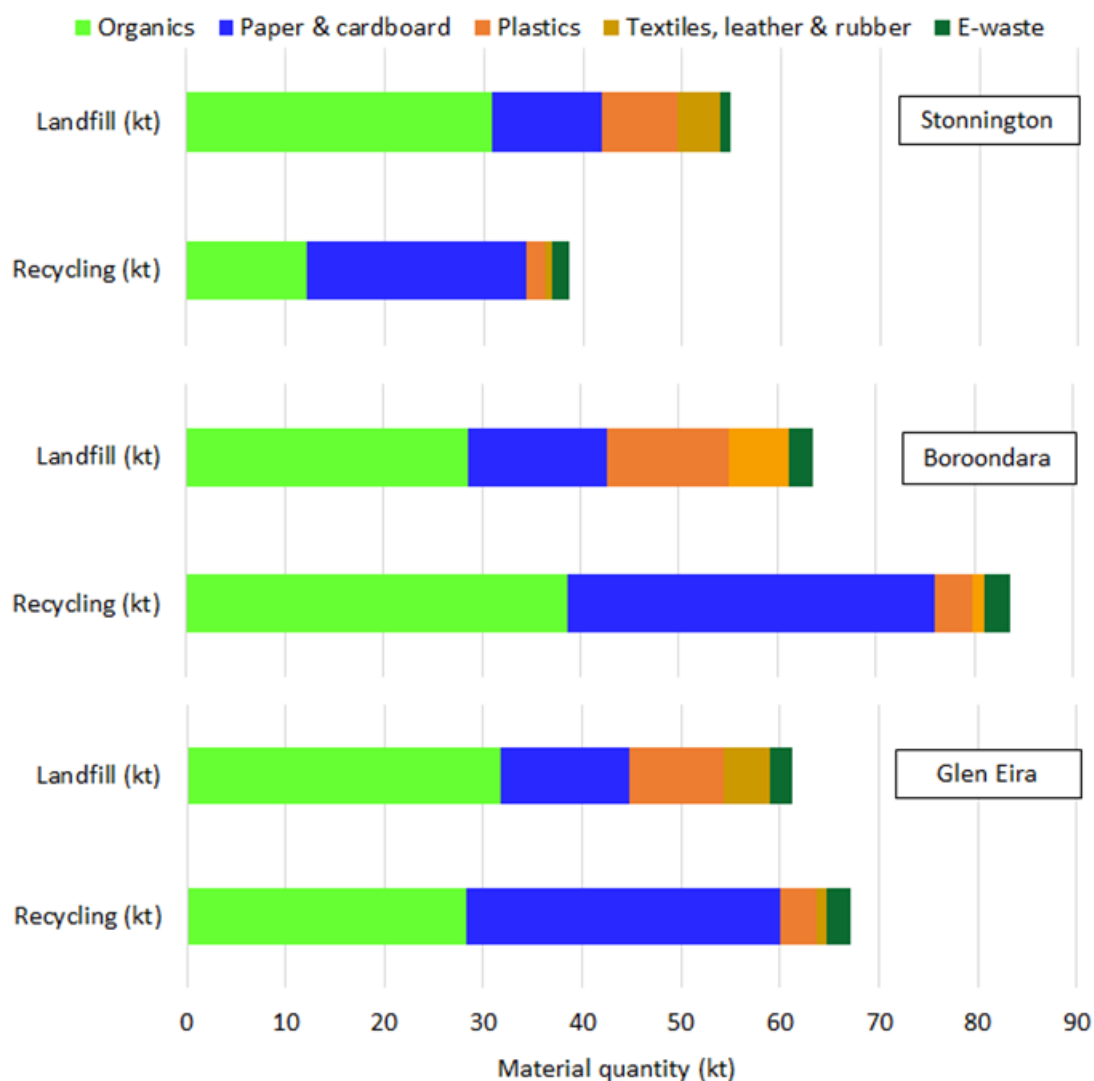
Material type	MSW			C&I			C&D			Total			
	Stonnington	Boroondara	Glen Eira	Stonnington	Boroondara	Glen Eira	Stonnington	Boroondara	Glen Eira	Stonnington	Boroondara	Glen Eira	Region
Food organics	14.3	10.2	13.0	6.5	10.4	9.2	0.1	0.1	0.1	20.9	20.7	22.3	63.9
Garden organics	7.6	23.1	17.3	3.1	5.0	4.4	0.5	0.8	0.7	11.3	28.9	22.4	62.5
Timber	0.2	0.7	0.3	7.0	11.2	10.0	3.6	5.8	5.1	10.9	17.7	15.4	43.9
Cardboard	3.4	4.9	4.4	18.3	29.3	26.0	0.3	0.5	0.5	22.1	34.7	30.9	87.6
Polymer coated paperboard	0.2	0.5	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.5	0.6	1.3
Newsprint & magazines	2.1	5.6	2.2	1.5	2.4	2.1	0.1	0.1	0.1	3.6	8.0	4.4	16.1
Office paper	3.0	1.4	2.9	4.2	6.8	6.0	0.0	0.0	0.0	7.2	8.1	8.8	24.2
PET (1)	1.6	1.9	2.0	0.9	1.4	1.3	0.0	0.0	0.0	2.5	3.3	3.2	9.0
HDPE (2)	0.4	0.8	0.5	0.8	1.3	1.1	0.0	0.1	0.1	1.2	2.1	1.7	5.1
PVC (3)	0.0	0.0	0.0	0.2	0.3	0.3	0.1	0.1	0.1	0.3	0.4	0.4	1.0
LDPE (4)	1.9	3.7	2.1	2.0	3.1	2.8	0.0	0.0	0.0	3.8	6.8	4.8	15.5
PP (5)	0.0	0.8	0.6	1.1	1.8	1.6	0.0	0.0	0.0	1.1	2.5	2.2	5.9
PS (6)	0.2	0.2	0.1	0.2	0.4	0.3	0.2	0.4	0.3	0.7	1.0	0.8	2.5
Textiles	1.6	2.2	1.3	2.9	4.6	4.1	0.2	0.3	0.3	4.6	7.1	5.7	17.4
Leather & rubber (excl.tyres)	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.4
E-waste	0.5	0.6	0.7	2.3	4.5	4.0	0.0	0.0	0.0	2.8	5.0	4.7	12.5
Total	37.3	56.6	48.0	51.1	82.5	73.2	5.0	8.1	7.2	93.5	147.1	128.3	368.9

Fates

As described in Section 3.4 the fate data is important to understand the type and quantity of materials that end up in landfill as compared to materials estimated to be recycled. The fate of materials by category is presented in Figure 11 with a more detailed summary, including estimated source stream splits and recycling rate, presented in Table 13. Key observations are:

- The estimated overall recycling rate for the selected material categories is 57 % for Boroondara 52 % for Glen Eira and 41 % for Stonnington Council.
- The difference in recycling rate for Stonnington is predominantly influenced by organics, for which the recycling rate is estimated at 28 % compared to 57 % and 47 % for Boroondara and Glen Eira Councils respectively. This is consistent with the MSW data provided by the Councils.
- While plastics are lower in overall quantity than organics, the recycling rates are also significantly lower at 24 % for Boroondara, 27 % for Glen Eira and 20 % for Stonnington. This highlights a need to significantly increase recovery of plastics.

Figure 11 Fate of key materials by material category and council, 2021–22 (kt)



Note, for the screened materials, the fate group 'other' is no longer relevant as it relates to biosolids, which was removed by the screening.

Table 13 Summary of material flows, for each Council, 2021–22 (kt or %)

Material category		MSW		C&I		C&D		All			
		Recycling	Landfill	Recycling	Landfill	Recycling	Landfill	Recycling	Landfill	Generation 2021–22	Recycling rate
Stonnington	Organics	5.6	16.7	4.9	11.8	1.7	2.5	12.2	30.9	43.0	28%
	Paper & cardboard	3.8	4.9	18.1	6.0	0.2	0.1	22.1	11.0	33.1	67%
	Plastics	0.6	3.5	1.3	3.9	0.0	0.3	1.9	7.7	9.6	20%
	Textiles, leather & rubber	0.0	1.8	0.7	2.2	0.0	0.2	0.7	4.2	4.9	15%
	E-waste	0.0	0.5	1.7	0.6	0.0	0.0	1.7	1.1	2.8	60%
	Total	9.9	27.4	26.7	24.4	2.0	3.1	38.6	54.9	93.5	41%
Boroondara	Organics	28.1	5.9	7.9	18.8	2.7	3.9	38.6	28.6	67.2	57%
	Paper & cardboard	8.0	4.3	28.9	9.5	0.4	0.2	37.3	14.1	51.3	73%
	Plastics	1.7	5.6	2.0	6.3	0.1	0.5	3.9	12.3	16.2	24%
	Textiles, leather & rubber	0.0	2.4	1.1	3.5	0.0	0.3	1.1	6.1	7.3	16%
	E-waste	0.0	0.6	2.7	1.8	0.0	0.0	2.7	2.4	5.0	53%
	Total	37.8	18.8	42.7	39.8	3.1	4.9	83.6	63.5	147.1	57%
Glen Eira	Organics	19.0	11.6	7.0	16.7	2.4	3.5	28.3	31.7	60.1	47%
	Paper & cardboard	5.7	4.4	25.7	8.4	0.3	0.2	31.7	13.0	44.7	71%
	Plastics	1.7	3.6	1.8	5.5	0.1	0.4	3.6	9.6	13.2	27%
	Textiles, leather & rubber	0.0	1.3	1.0	3.1	0.0	0.3	1.0	4.7	5.7	18%
	E-waste	0.0	0.7	2.4	1.6	0.0	0.0	2.4	2.3	4.7	51%
	Total	26.4	21.6	37.8	35.3	2.8	4.4	67.1	61.3	128.3	52%

The table above is presented separately for each council in Appendix E.

The breakdown by material types is presented in Figure 12 and Table 14. Some variation occurs between the Councils as is consistent with the MSW data provided, with estimated quantities also influenced by population. Within the organics category, already highlighted for attention, a notable quantity of food organics are ending up in landfill. This identifies a priority area for increased recovery and possibly avoidance where food waste can be prevented. Figure 12 is presented separately for each council in Appendix E.

Figure 12 Fate of key material types by council, by recovery and disposal groupings, 2021-22 (kt)



Table 14 Fate of the key materials by council, by recovery and disposal groupings, 2021–22 (kt)

Material type	Recycling			Landfill			Total			
	Stonnington	Boroondara	Glen Eira	Stonnington	Boroondara	Glen Eira	Stonnington	Boroondara	Glen Eira	Region
Food organics	1.9	7.5	4.4	19.0	13.2	17.8	20.9	20.7	22.3	63.9
Garden organics	6.8	25.6	19.0	4.5	3.3	3.4	11.3	28.9	22.4	62.5
Timber	3.5	5.5	4.9	7.4	12.1	10.4	10.9	17.7	15.4	43.9
Cardboard	16.2	26.5	23.3	5.9	8.2	7.6	22.1	34.7	30.9	87.6
Polymer coated paperboard	0.0	0.2	0.0	0.2	0.3	0.6	0.2	0.5	0.6	1.3
Newsprint & magazines	1.2	4.4	1.9	2.5	3.6	2.5	3.6	8.0	4.4	16.1
Office paper	4.8	6.2	6.5	2.4	2.0	2.3	7.2	8.1	8.8	24.2
PET (1)	0.6	1.1	1.3	1.9	2.2	2.0	2.5	3.3	3.2	9.0
HDPE (2)	0.4	0.9	0.7	0.9	1.2	1.0	1.2	2.1	1.7	5.1
PVC (3)	0.1	0.1	0.1	0.2	0.3	0.3	0.3	0.4	0.4	1.0
LDPE (4)	0.5	0.8	0.7	3.3	6.1	4.2	3.8	6.8	4.8	15.5
PP (5)	0.3	0.8	0.7	0.8	1.7	1.5	1.1	2.5	2.2	5.9
PS (6)	0.1	0.2	0.1	0.6	0.8	0.7	0.7	1.0	0.8	2.5
Textiles	0.7	1.1	1.0	3.9	5.9	4.7	4.6	7.1	5.7	17.4
Leather & rubber (excl.tyres)	0.0	0.0	0.0	0.2	0.2	0.0	0.2	0.2	0.0	0.4
E-waste	1.7	2.7	2.4	1.1	2.4	2.3	2.8	5.0	4.7	12.5
Total	38.6	83.6	67.1	54.9	63.5	61.3	93.5	147.1	128.3	368.9

4.3 Future materials for analysis

The next ranked material categories, of those included in the full MFA are glass and tyres equally, then building and demolition materials.

In brief considerations might include the following:

- Glass is a SV priority material which has mature interventions in train. These include the existing export ban, household recycling reforms and the approaching container deposit scheme. The Councils priorities are likely to be driven by the mandatory policy requirements as well as opportunities to enhance glass collection in the region.
- Tyres is a SV priority material with some existing interventions in train, including the ban from landfill and national Tyre Product Stewardship Scheme. Tyres are listed as a national priority for the first time in 2022-23 ([DCCEW 2022](#)), with the focus on strengthening industry-led product stewardship. This includes increasing the onshore consumption and recovery rate of all EoL tyres. One way the Councils can contribute is by using tyre crumb in road construction.
- Building and demolition materials consist of a range of material types which generally have higher recycling rates than organics and plastics. While not a current SV priority, the quantity used of some material types in this category is high and councils are in a position to influence usage and avoidance so should consider investigating available options. .

5. Intervention analysis and actions

A list of 17 potential interventions were considered in this project, falling into seven intervention streams. They were developed in conjunction with Councils based on general options available to councils and the research findings during this project. The summary list of intervention streams is:

- council policy and regulation
- council procurement
- council support
- data
- diversion of materials
- knowledge and capability building
- innovation, research and pilots.

The full list of interventions streams and related interventions are provided in Appendix A3.

5.1 MCA outcomes

The MCA is developed separately for each Council to allow future use by the three councils. It is important to note that only the criteria for waste to landfill and climate change vary for the Councils as these are influenced by local waste generation and population. We note that the differing amounts of MSW generated by each council has minimal impact on flows when combined with the C&I and C&D source streams.

Interventions with the same MCA score have the same rank (for example, if there are 2 interventions that are ranked first equal, the next item will be ranked third in the list and so on). Given the uncertainties associated with the MCA methodology, such as various forms of bias, criteria coverage of impacts, and other limitations (IA, 2021, pp. 12-14), all of these interventions could be conservatively interpreted as having similar rank.

The top 20 interventions across all material types were collated to assess any variation in the MCA results across the three councils. The table of top 20 interventions for each council is provided in Appendix D. Apart from slight variation in the order that interventions ranked, we observed reasonable consistency in the top 20 interventions across all material types for each council.

A key observation is that the material types that dominate the top 20 are plastics followed by organics, which ranked two and one respectively in the material screening. This provides a useful guide about where to focus action through the lens of material type within the material categories.

5.2 Action plans

This section provides a proposed action plan for the top ranked interventions by material type. The top 3 ranked interventions are selected for each material type. There is no variation by Council for the top 3 ranked interventions by material type, so the same interventions are considered for development of actions across the Councils, but where possible actions have been developed with council specific opportunities in mind.

For each prioritised intervention we have developed at least one action. The actions were informed by Blue Environment staff knowledge and experience and the research conducted for this project, thus were not determined through the MCA and are more subjective in nature.

We note that some actions are already in the Councils existing plans and strategies. This is not surprising given the Councils have had programs and initiatives in place for many years to tackle climate change and waste reduction and avoidance. Detailed assessment of existing actions and strategies was beyond the scope of this project.

The interventions and actions proposed are intended to provide priority areas for focus, but as noted in the method section, an MCA should be seen as a filter only, and not as a tool for definitively selecting specific projects or programs. It is also worth noting the highest ranked interventions were scored based on Blue Environment's judgement with no weighting applied. There may be other factors or Council preferences that could preference lower ranked interventions. Also we have made the model so that councils can add weights to the various scores to assess the sensitivity of the result in the future.

The timeframe in the action plan is broadly based on council planning cycles of annual budget planning (short term), strategies of three-to-five years (medium term) and infrastructure roadmaps (long term).

Foundational actions

Several of the proposed interventions can be described as foundational, in that they should provide a strong footing for all circular economy endeavours for the Councils. The foundational interventions are often strategic and are relevant regardless of the material type. The interventions listed in Table 15 are identified as foundational and have actions proposed regardless of MCA ranking. It is worth noting that the four listed interventions featured frequently in the top three ranked interventions across material types.

Table 15 Foundational interventions and recommended actions

Stream	Intervention	ID	Proposed actions	Commentary	Timing
Council policy and regulation	Integrate circular economy into council policies and strategies.	1.	Map and review relevant Council strategies, plans, and policies to ensure circular economy principles are embedded. Areas of focus could be: • Council's Procurement Policy. • Single Use Plastic avoidance at events • Circular economy aspects within development • Requirements of waste contracts (e.g. visibility of material fate post collection)	Systemic change is needed across all sectors of the economy, with governments, businesses and communities all playing an important role, so it stands to reason that all policies and strategies in a Council need to reflect the principles and practices that will enable the transition to circularity. We note the relative maturity of the Councils, each with existing sustainability focussed strategies and plans and circular economy aspects within the procurement policy. This provides a strong foundation for the Councils and we note local governments are encouraged to adopt a similar procurement approach to the State as set out in Victoria's Recycled First Policy (2020).	M
Data	Create metrics and targets and track progress towards a circular economy.	2.	Build on existing relevant metrics to develop circular economy metrics and targets. <i>(Alternate action for Glen Eira)</i> Review alignment of circular economy metrics and targets with SV/RV framework once it is finalised.	Effective metrics are essential for a circular economy to measure progress. There are many potential metrics, and the anticipated State level framework (discussed in Sub-section 6.1) should provide Councils with a useful reference to be able to identify the metrics that are most helpful for their context. We note there is an opportunity to collaborate with Glen Eira Council, which has a set of circular metrics in its recently approved Circular Economy Plan 2022–26. Useful metrics may include recycling rate, participation rates, spend on activities, tonnage of recycled materials used and transition metrics such as number of circular businesses and metrics to show councils circularity.	S
		3.	Review data management within Council and implement procedures to capture, maintain and analyse datasets to inform circular economy decision making.	We note for this project the Councils were able to provide a range of information, however Councils identified challenges and gaps with some requested data. Challenges included inconsistent ways of collecting data, some conflicting internal MSW data sources and lack of specific data on council use of recycled material Gaps included a lack of C&I and C&D data. Establishing fit for purpose data management and gathering required data is a ubiquitous challenge, particularly in government. The Councils understand the importance of data analysis and tracking to understand progress to targets and effectiveness of	S-M

Stream	Intervention	ID	Proposed actions	Commentary	Timing
				activity but the required capacity for data management is often under-estimated. There is an opportunity to leverage foundational action 4 to engage all departments in data needs and approach.	
Knowledge and capability building	Educate departments across LGAs on the principles of the circular economy.	4.	Develop and implement an education program on the principles of the circular economy for all departments in the Council.	Circular economy requires a paradigm shift in thinking to make system-wide change. This requires all parts of council to understand circular economy principles, which as identified in a recent report on the state of circulatory in Australia (ACE Hub 2022b), will help them identify intervention points across the LGA. There are a growing range of online education programs on circular economy. We understand the free six week program offered by the United Nations System Staff College has been popular for State and Local Government in Victoria.	S
Knowledge and capability building	Council communication program to demonstrate the paradigm shift to a circular economy.	5.	Develop and deliver a communications strategy to increase circular economy awareness and to spark innovation across local community and business.	In Australia circular economy adoption is in its infancy. Wide-ranging and broad communication from national and State levels is needed, but councils hold a unique position in that they tend to know and understand their constituents and have regular contact via various council services. Building circular economy awareness is imperative to enable change. During consultation we found major stakeholders including Monash University, Chadstone Shopping Centre and resource managers expressed a strong interest in supporting the Councils to pursue a circular economy. Further engagement with these major players can inform communication opportunities.	Ongoing
		6.	Promote existing circular economy opportunities and success stories to create an accessible path for businesses to start their circular economy journey.	We note Stonnington and City of Melbourne have partnered with Boroondara to host the Go Full Circle Program (developed and owned by Boroondara Council), which provides training to business owners or staff of a small-to-medium business operating in the hospitality, retail, or professional services industries. Promoting the success stories of participating businesses as well as identifying local B Corp-certified business is one way to create a pathway.	Ongoing

Organics

Food waste is a priority both nationally, and for Victoria with a target for 100 per cent of households to have access to a separate FOGO service or local composting by 2030 (DELWP 2020). Significant household reforms are driving state-wide action that is anticipated to divert significant amounts of MSW from landfill. It is worth noting that all three Councils have implemented municipal FOGO collection with Boroondara Council operating a best practice system, having transitioned to fortnightly garbage. A remaining area of opportunity is commercial FOGO which is likely to be generated in the region through hospitality and retail trade (cafes, restaurants, bakeries, supermarkets etc.). The largest employers in healthcare, accommodation and education facilities are also likely to produce notable quantities of food organics.

SV and the former MWRRG commissioned an audit of the hospitality and retail sector which found organic materials, mostly food waste, tended to be the most substantial component of businesses' waste streams (First Person Consulting 2021). Unavoidable food waste typically accounted for about half (48%) of the organics stream with the remaining quantity split between avoidable food waste (30%) and possibly avoidable food waste (20%). Only a small proportion of waste generated by these businesses is classified as green waste (1%). The study found that food waste was particularly prevalent in the waste streams from bakeries (65%), fruit and vegetable stores (52%), cafés and restaurants (60%) and takeaway stores (57%). Retail trade and healthcare are well represented in the region, which presents an opportunity for Councils to drive avoidance of food waste in the commercial sector.

Timber is largely generated in the C&I and C&D streams, although households also produce limited amounts. Opportunities for timber recovery include salvage, reconditioning and reuse of single use timber pallets for transport and export of goods, shredding pallets and joinery waste as landscaping mulch and recovery of timber for bioenergy and/or as an input into biochar productions.

Table 16 identifies the highest ranked interventions (top 3) that remain after separation of the foundational intervention (for a council communication program) for each material type. It is worth noting that similar interventions ranked in the top three for each material type. The intervention to increase recovery of materials as a resource (e.g. maximise recycling and reduce contamination) ranked 2nd for timber and 4th for food organics and garden organics. Blue Environment included FOGO for consideration given the impetus to address commercial FOGO in the State policy, Recycling Victoria: A new economy (2020).

Table 16 Highest ranked interventions and recommended actions by organics material types

Materials	Intervention	ID	Proposed actions	Commentary	Timing
Food organics, Garden organics	Council procurement of recovered materials to provide significant and reliable end markets.	7.	Identify types and products of compost materials used by Council and determine obstacles to using locally recycled materials to develop a plan for purchase of recycled compost materials from organics recycler. <i>(Alternate action for Stonnington)</i> Maximise purchase of recycled compost materials from organics recycler across types and products used by Council.	Using materials recovered from Council waste generation is an excellent way to provide significant and reliable end markets. It also enables Council to demonstrate their own circularity for showcasing to others. The SV procurement toolkit for Local Government (SV 2022a) would aid with this action. We note Stonnington Council already purchase recovered organic material from the local reprocessor, Biogro.	S-M
Food organics, Garden organics	Create incentives and provide support to improve circular economy outcomes.	8.	Develop and offer an advisory service to constituents that can support circular economy initiatives.	Councils generally have good in-house capability for educating, developing grant applications (advising on business cases) and facilitating business-to-business relationships. In contrast small business may not have enough time or expertise to pursue circular economy initiatives without targeted support. Considering the types of businesses in all three Councils this could be a useful service for restaurants and cafes or even the healthcare sector. Councils could also monitor waste composition, streams and destinations to identify if a waste output can be an input for another business. To reduce burden the three Councils could form a network and offer a single service across the three LGAs to build expertise and capacity for an advisory service.	M
Timber, Food organics*, Garden organics*	Increase recovery of materials as a resource (e.g. maximise recycling and	9.	Investigate opportunities to reduce commercial FOGO disposal to landfill. This could consider commercial FOGO collection as well as education campaigns on ways to avoid food waste.	There are limited Council-run FOGO collection services for commercial premises in Victoria despite some industry sectors producing significant amounts of FOGO. Councils have significant experience in running or facilitating effective waste collection services that may suit small-to-medium businesses. The focus on commercial waste is likely to increase given the State government signal that it will introduce rules by 2025 to require businesses to	S-M

Materials	Intervention	ID	Proposed actions	Commentary	Timing
	reduce contamination).			sort commonly recyclable materials and organics from unrecoverable wastes (DELWP 2020).	
		10.	Implement best practice FOGO collection for households. We note Boroondara Council already operates a best practice approach so this action should focus on reducing the contamination rates in municipal collection.	Best practices including a weekly FOGO service, provision of caddies and liners and regular clear communication aims to maximise FOGO collection for recovery while reducing contamination of other waste streams with organics. As noted in Section 4.2 Stonnington has a lower recycling rate than Boroondara and Glen Eira, mainly due to the organics recycling rate. Due to this we suggest Stonnington identify what is leading to the lower rate and tailor this action to target identified issues.	S-M
Timber	Encourage consumers and businesses to purchase recycled content products.	11.	Provide communications around recycled timber options and where these can be used.	Councils are well positioned to provide information on services and sources of recycled products to community and businesses. Several well-known businesses offer salvaged timber around Melbourne, such as Urban Salvage and Shiver Me Timbers . CERES , Fair Wood supplies farm forested and salvaged timbers, connecting people with sustainable timber and firewood suppliers.	S
		12.	Lead the way by demonstrating use of recycled timber for Council works where possible	Councils have significant buying power and play a critical role in driving markets for recycled products and materials and fostering innovation. Leading by example is an excellent way to encourage others to do the same.	S-L

Plastics

Globally, plastics are the subject of sustained attention due to the quantity of material, nature of use and pollution impacts. About 2,630 kt or 102 kg per capita of plastic waste was generated in Australia in 2020–21, with only about 13 % recovered. Victorians disposed about 230 kt of plastic to landfill in this time from municipal sources (Blue Environment 2022b).

In Victoria, there continues to be significant and growing local demand for high quality PET, HDPE and PP packaging scrap material for remanufacturing. There exists a good number of reprocessors and users for LDPE and PP, but a significant reprocessing capacity gap for end of life and insufficient local end markets. Good export markets exist for high-quality sorted/washed flake and pellets, which is not subject to the COAG export bans, and commodity prices are strong. Local reprocessors prefer higher value plastics, such as those from CDS, to kerbside sources.

Plastics collected through kerbside collections are generally sent to MRFs and sorted from commingled recycling into either a single mixed plastics grade (1–7 plastic-polymer mix), or more commonly three or four grades, which are PET, HDPE and the residual mixed plastics grade (a 3–7 plastic-polymer mix, but with some residual quantities of PET and HDPE still present). It is important to note that PVC and PS are now being proactively phased out from use in packaging by many brand-owners, and the quantities of these polymers in kerbside collections are already low and continue to fall.

Retail outlets generate a range of plastic material (e.g. shrink wrap, packaging tape, expanded polystyrene, packing foods) as does the healthcare sector, which is a significant employer in all three Councils. Plastics in healthcare are listed as a national priority for a product stewardship scheme for the first time in 2022–23, presenting an opportunity for the Councils to consider ways to partner with, or influence this sector.

Retailers are uniquely positioned to drive circularity due to their direct role in the value chain and influence on customers. Circular initiatives such as buy-back schemes, donation programs, the use of reusable and/or package-free products and the boycotting of single-use plastics can progress the circular economy. The Councils can support retailers with information, advice and guidance.

Finding productive uses for recovered plastics in Australia is a key challenge. The opportunities include:

- use in civil infrastructure
- chemical recycling to break plastics down into their chemical building blocks from which new plastics can be created.

New advanced (chemical) recycling operations present an opportunity for Councils to explore partnerships and investigate expansion of collection systems in the LGA. Advanced recycling projects are likely to come into operation nationally across the 2023–25 period, according to the SV market bulletin (SV 2022b). These facilities will target the flexible plastic packaging generated by households, along with other non-kerbside related scrap plastics. Three examples of projects are:

- Licella and IQ Renew, have the most progressed advance recycling project, with an EPA permission in place for a plant in Altona, and planning to be operational in 2023 or 2024.
- In Victoria, Qenos and Cleanaway partnered to undertake a joint feasibility study for plastic-to-plastic advanced recycling using a collection trial for soft plastics in the City of Melbourne ([Cleanaway 2022](#)).
- Following the collapse of REDcycle, Monash Council partnered with APR Plastics to set up a new soft plastics recycling scheme in December 2022 ([Monash City Council 2022](#)). Other councils such as Yarra City Council are also working with the Dandenong-based company, which will turn soft plastics (HDPE, LDPE and PP) into oil that can be used to produce soft packaging.

Presented in Table 17 are the top ranked interventions for the six plastic polymers identified by codes one to six, after separation of three of the four foundational interventions.

Table 17 Ranked interventions and recommended actions by plastics material types

Materials	Intervention	ID	Proposed actions	Commentary	Timing
PET (1) HDPE (2)	Increase recovery of materials as a resource (e.g. maximise recycling and reduce contamination).	13.	Investigate expanded residential and business drop off for different plastic products, via kerbside and at transfer stations.	Provided the reprocessing options are available, expanding collection of polymer types will provide increased feedstock for recycling plastics. We understand there is also work underway to standardise kerbside collection and we suggest the Councils contact relevant agencies to determine status; and maintain a watching brief on developments.	M
PET (1) HDPE (2) LDPE (4) PP (5) PS (6)	Encourage consumers and businesses to purchase recycled content products.	14.	Support the expansion of the Australasian Recycling Label (ARL) to communicate recycled content where this aligns with the standard materials acceptance lists.	The ARL is being updated to provide consumers with information on recycled content. Encouraging the wide uptake of this change by brands, and communicating this change to consumers, supports the creation of an end-market pull through to ensure secure, expanding, high value markets for polymers. However, we note there are some inaccuracies in the ARL for Victoria which can take time to update. Other actions such as a regional education campaign could be used to support this action where there is a mis-alignment.	S
PET (1) HDPE (2) LDPE (4) PP (5) PS (6)	Create incentives and provide support to improve circular economy outcomes.	15.	Develop and offer an advisory service to constituents that can support circular economy initiatives. (See action 7)	See action 7 for commentary.	M
		16.	Maintain a watching brief on developments on the brand and verified labelling scheme for Australian-made products made from recycled content – “ReMade in Australia”. When appropriate promote this scheme to community and businesses.	The Australian Government is developing a brand and verified labelling scheme for Australian made products from recycled content (ReMade in Australia). We suggest the Councils maintain a watching brief on developments.	S
PET (1)	Encourage consumers and businesses to choose products (or services) to achieve a higher order end of life fate.	17.	Promote organisations with services or programs that are designed to enable businesses to avoid single use plastics.	Boomerang Alliance’s Plastic Free Places program (Plastic Free Places) offers solutions to eliminate single-use plastics for food retailers, events, markets and councils. We note Glen Eira Council has implemented a plastic free trial and Boroondara has a plastic project in Camberwell. This action should focus on using lessons to expand existing projects to other businesses or consider opportunities at Council events.	S

Materials	Intervention	ID	Proposed actions	Commentary	Timing
				A Victorian company B-Alternative (see case study in Appendix C1.2) provides alternatives for products and offers reusable crockery for events, among other things. Green My Plate provides a similar service and we understand that Stonnington has found them highly suitable for recent local events.	
		18.	Support and promote business which provide services to avoid disposal of single use packaging (e.g. refill services)	Refill services are those where bottles containing common household consumables (e.g. dishwashing liquid, body wash) can be refilled continuously instead of being used once. These are provided through collaborative arrangements between companies such as Unpackaged Eco and partnering retailers and chains. Councils could support and encourage such initiatives through Council resources. This may be complimented by the promotion of the ASPIRE marketplace (see case study in Appendix C1.2) if	S-M

Paper and cardboard

Overall, the quantity of paper and cardboard EoL generation is declining due to digitisation of information, but the quantity is still substantial. In the region, estimated paper and cardboard generation is 128 kt compared to 41 kt plastics (Table 7). There is a gap between EoL generation and processing capacity for paper/cardboard and it is worth noting that from July 2024, Australia will regulate paper and cardboard exports from mid-2024 through the implementation of a licencing and declaration scheme.

At present polymer coated cardboard is hard to sort and value-add to a sufficient quality level to meet end market requirements. However, in September 2022, the Victorian Government funded a significant activity to recycle liquid packaging board (LPB) of various types, extending to numerous polymer coated packaging formats (e.g. coffee cups). The recycling process creates a fibre-polymer composite board product, suitable for a range of building and construction activities. This development of [saveBOARD](#) products could result in increased sorting and recycling of the target materials, with the co-benefit of improving the quality of the residual mixed recovered paper sorted from kerbside collections.

Retail outlets generate large quantities of paper and cardboard where products typically arrive at shopfront in cardboard packaging, which is the dominant retail waste. The audit of the hospitality and retail sector commissioned by SV and the former MWRRG (First Persons Consulting, 2021), which was also discussed in relation to organics, found that packaging materials including cardboard may be avoidable by implementing new systems that avoid single use items. Key businesses here would be cafes/restaurants, grocery stores/supermarkets and takeaway food stores. Liquid paperboard (polymer coated

paperboard) was identified as the next most significant opportunity to divert avoidable material from landfill. This report identifies the two key opportunities are to improve paper/cardboard diversion (or increase recovery) and reduce contamination in comingled and paper/cardboard streams.

Presented in Table 18 are the top ranked interventions for cardboard, office paper, newsprint and magazines and polymer coated paperboard, after separating the four foundational interventions.

Table 18 Ranked interventions and recommended actions by paper and cardboard material types

Materials	Intervention	ID	Proposed actions	Commentary	Timing
Cardboard, Newsprint & magazines, Office paper	Increase recovery of materials as a resource (e.g. maximise recycling and reduce contamination).	19.	Educate users of paper how to preserve and recover the value of cardboard and paper.	One of the key challenges is contamination of paper in the co-mingled recycling bin reducing the recyclability of recovered fibre (CSIRO, 2021). This action might be supported by a communication campaign (see foundational action 5) and the Councils can also consider the need to reduce the application of difficult-to-recycle stickies.	M
		20.	Seek reporting of data on the recovery rate per material from respective MRFs via the tender/contract process.	Greater understanding of the fate of collected recyclables by each Council can be used to drive targeted action to increase recovery of materials.	M-L
		21.	Investigate opportunities to offer and increase cardboard collection services for small businesses.	Cardboard packaging dominates waste produced by retail outlets, a prevalent business type in the region. Easy to access collection services play an important part in encouraging businesses to recycle. Port Phillip Council offers a free cardboard collection service to businesses on major shopping strips with loose cardboard collected on bin day. Lessons from this service may be of value for the region. We note Glen Eira operates a bulk cardboard collection booking system and Boroondara provides a recycling service to approximately 3600 businesses.	S-M
Cardboard, Newsprint & magazines, Office paper	Council procurement of recovered materials to provide significant and reliable end markets.	22.	Prioritise purchase of recycled products and promote expanded use of recycled fibre packaging.	Local government are a significant consumer and can drive increases in consumption and production. Councils also have an opportunity to demonstrate circularity through procurement of recovered materials. We note that avoiding paper to the extent practicable presents a desirable higher order approach for office paper and paper products. This might involve supporting the digitisation of information (the	S

Materials	Intervention	ID	Proposed actions	Commentary	Timing
				'paperless' office) across all departments in Council and substitution of disposable paper products with reusable products.	
Cardboard, Office paper	Encourage consumers and businesses to purchase recycled content products.	23.	Promote expanded use of recycled fibre packaging, in preference to other material types.	Most paper production in Australia is used in packaging, particularly in manufacturing cardboard boxes (CSIRO 2021) Consider promoting the proportion of recycled content products purchased by the Councils to set a good example and to demonstrate opportunities to businesses.	S-M
Polymer coated paperboard	Advocacy to State and National government to improve circular economy outcomes.	24.	Consider advocacy through action by procuring products made from recycled polymer coated paperboard.	By acting, the Councils can promote, and in turn advocate, for the product saveBOARD which is discussed in the section overview above.	M

E-waste

Data on product wastes may sometimes be needed (for example, for product stewardship programs). E-waste is a product type for which data is available separately, because it is easier to classify by product than directly allocating to material types. E-waste includes:

- televisions and computers
- mobile phones
- white goods and other large appliances
- batteries other than used lead acid batteries
- cables.

The quantity of e-waste generated is relatively small compared to, for example, organics, but can contain valuable components as well as toxic substances. Although banned from landfill in Victoria, some almost certainly still ends up at this destination. Modelling commissioned by the Commonwealth (Bontinck et al. 2021) estimates that 531 kt of e-waste was generated in Australia in 2020–21, up 2.6% on the previous year. Roughly 54% of all e-waste is sent for recycling processes that recover about 35% of the material inputs. Recovery rates are highest for television and computing equipment (covered by the National Television and Computer Recycling Scheme) while simpler metal scrapping is highest for temperature exchange equipment, large appliances and other large equipment. Measurable product design improvements are expected from manufacturers, importers, distributors and retailers by 2025.

At a local level, supporting the grassroots repair cafes and men's sheds presents an opportunity for Councils to reduce unnecessary disposal of e-waste and to promote the benefit of repairability. A community map provided by Stonnington Council lists more than 20 groups in this region and surrounding

councils, targeting social and environmental initiatives. Stonnington and Boroondara Councils' have transfer stations which collect larger e-waste, and all three Councils provide collection locations for small recyclable e-waste.

Presented in Table 19 are the two top ranked interventions for e-waste, after separating the four foundational interventions. Five interventions ranked equal second for e-waste, so in total six interventions have actions.

Table 19 Ranked interventions and recommended actions by E-waste material types

Materials	Intervention	ID	Proposed actions	Commentary	Timing
E-waste	Create incentives and provide support to improve circular economy outcomes.	25.	Investigate opportunities to support repair cafes and men's sheds, for example consider providing rate holidays, and ensure waste collection is fully integrated with the local repair system.	Grassroots repair cafes, Men's sheds and related social enterprises provide multiple benefits for the community, including social connection and skills development. We recommend speaking with a range of these groups to understand their experiences and find out what Councils can do to help. Seeking information on what is hard versus easy to repair could inform targeted collection or even an offtake from the transfer stations to integrate waste collection with local repair system.	S-M
		26.	Promote services and organisations, suited for small businesses, which collect e-waste.	There are a range of existing services using circular business models accessible to the Councils. For example, GreenCollect provides an E-waste collection service for small items.	S
E-waste	Advocacy to State and National government to improve circular economy outcomes.	27.	Advocate for policy to require repairable products (e.g. televisions and computers, mobile phones, white goods and other large appliances).	Planned obsolescence increases the quantity needed of new resources (materials) except if a product is designed to be broken down into fully recoverable components. Repairing products generally extends the life of the item, although can be more expensive than a new item, especially if brand owners are not required to consider the whole of life cost, which then creates externalities, often resulting in a cost to the environment. Aligned and informed council advocacy to state and national governments can play a proactive part in a national approach to transitioning residents and businesses to new circular systems for electronic products.	S-M

Textiles

Textiles are on the national list for making product stewardship a priority. The scope of textiles in the priority list is limited to clothing which is estimated at about a third of all textiles (BE 2022a). An analysis of national textile product imports (by tariff codes) found that clothing was found to comprise of 36% of all textiles, with other major categories being furnishings and bedding (17%), raw textile for local manufacture (17%) and carpet (10%) (ACTA 2021). Of the major component of textiles, clothing, about 300 kt is discarded each year, of which about 100 kt is sent to landfill and 200 kt is given to clothing donation or collection services (AFC 2022).

The quantity of EoL textiles is relatively much lower than paper/cardboard categories but there is a significant gap between EoL generation and reprocessing infrastructure for unwearable/unsaleable clothing in Victoria, presenting a challenge for reducing the quantity to landfill. No formal collection service exists for reused textiles; collections are mainly run by charities. Improvements in technology are producing higher material yields in recycling but these are not yet widely used in Australia. An industry-wide stakeholder group has been established.

While clothing manufacture is not prevalent within the Councils, retail trade features in the top four sectors in relation to full-time equivalent (FTE) employees in the region. Socially and environmental conscious fashion is also an emerging trend with sustainability becoming increasingly mainstream. This presents an opportunity for partnerships and promotion of circular practices in the region. Charity shops, social enterprises such as Fitted for Work, and repair cafes are also a feature of the region and surrounding councils. These organisations play an important role in the clothing value chain as well as providing social benefits.

We note mattresses are of interest to the Councils. For the first time, in 2022–23, mattresses are listed as a national priority for product stewardship ([DCCEEW 2022](#)). Mattresses contain a range of materials such as natural and synthetic fibres, metal springs, latex rubber polyurethane and memory foam. The viability of recovery is hindered by low, or no value materials typically used within mattress. The current focus is to increase participation in the existing industry-led product stewardship scheme for mattresses and bedding and expand it to include additional products. The increased priority may present opportunities for Councils to influence, as the National Government considers the merits of a formalised scheme.

With equal rankings, seven interventions are ranked highest for the material type textiles and five for leather and rubber. The four foundational interventions are in the highest rankings and have been covered earlier and this leaves three interventions for consideration by material type as listed in Table 20. The actions are focussed on the material type textiles. Table 12 in the key material summary shows leather and rubber has a very low EoL generation and for this reason it is not recommended for specific priority action/s.

Table 20 Ranked interventions and recommended actions by textiles material types

Materials	Intervention	ID	Proposed actions	Commentary	Timing
Textiles	Create incentives and provide support to improve circular economy outcomes.	28.	Investigate opportunities to support local charity shops and repair shops.	Charities target about a third of textiles that go into apparel. For this reason, it is worthwhile engaging with local charity and repair shops to identify the opportunities for Councils to provide support either in kind or financial relief (e.g. rate holidays).	S-M
		29.	Promote options for recycling textiles and partner with leading organisations to subsidise these services for residents and businesses; also, where possible buy products.	Increasing awareness for local textile recycling initiatives builds usage of the services. In turn this can strengthen the viability of the market. The Southern Cross Recycling Group (SCR Group) discussed in case studies (Appendix C1.2) is one organisation which collects unwanted clothing from national drop-off hubs to be sorted. Where relevant, Councils can also purchase products made from reprocessed textiles. For example In Melbourne Upparel sort out unwearable clothing from its clothing collections for use in pillows, insulation and furniture.	S
Textiles Leather & rubber (excl. tyres)	Advocacy to State and National governments to improve circular economy outcomes.	30.	Advocate for State and national governments to support investment in onshore facilities to sort, process, repair and re-manufacture recovered textiles, the establishment of product stewardship schemes and introducing Right to Repair legislation.	Councils can play a proactive part in a national approach to transitioning residents and businesses to new circular systems of textile production through aligned and informed council advocacy to state and national governments.	M
Textiles	Partner with major waste generators to avoid and reduce waste.	31.	Gauge interest for partnering with hospitals to avoid and reduce textile waste (e.g. uniforms).	Most representatives consulted for this project expressed interest in partnering with Councils to improve circular economy outcomes. The Health Care & Social Assistance sector has the highest number of employees by FTE in each of the three Councils. Organisations such as Upparel collect uniforms and unwanted stock and can be promoted to business and other organisations. We note that Stonnington has partnered with Upparel to provide discounted textile recycling rates for Stonnington residents.	M

6. Circularity and benchmarking

Provided in this section is a synthesis of the information review, stakeholder consultation and other project findings, to inform the provision of a benchmark of the Councils' circularity against other cities in Australia and internationally.

6.1 Framework and metrics

Although the concept of a circular economy is not new, measurement of circularity could be described as in its infancy, with a lack of widely accepted, standardised measurement frameworks for circular economy yet in existence. A range of frameworks for business, country and city measurement exist globally but none uniformly in Australia. For example, the Ellen MacArthur Foundation, an internationally recognised leader promoting circular economy principles and practices, provides *Circulytics*, a tool with a range of indicators to help business measure its circular performance and potential.

Also recognised internationally are Circle Economy, based in the Netherlands, which has for five years provided a *circularity gap report* (Circle Economy, 2022). Looking at material flows by weight and the proportion recirculated, the most recent report assesses the world as only 8.6% circular (Circle Economy, 2022). At a global, and perhaps national scale, a measure of circularity is useful for policy and decision makers, however at the local level this type of indicator may be less useful as a circulatory measure alone cannot direct a LGA where to invest their energy.

There is no shortage of metrics in use to measure circular economy characteristics as demonstrated by the Organisation for Economic Cooperation and Development (OECD) which compiled 474 circular economy indicators derived from a review of studies of cities and regions (OECD, 2021). However as identified by the Australian Circular Economy Hub there is a clear need for Australia to implement a circular economy measurement framework to guide measurement at all levels. Informed by the Metrics Working group of the Hub and other expert contributors they identified a potential measurement framework could include headline, impact and transition indicators to capture varying elements of the circular economy (ACE Hub 2022a).

SV developed a draft circular economy measurement framework, launched in 2021. The framework includes three headline whole of economy indicators, numerous transition indicators and five impact indicators, to measure the effect of the economy on greenhouse gas emissions, biodiversity, employment, health and well-being (ACE Hub, 2022a). Our understanding is that SV anticipates the framework will be released in early 2023 and intends to create a Victorian baseline report with localised information to enable use by councils.

6.2 Benchmarking

In the absence of consistent, accepted indicators and metrics it is neither possible to measure the region or Councils circularity, nor is it possible to accurately benchmark against Australian and global cities. It is anticipated the SV framework will provide a starting point for alignment across Victorian Councils, although broader comparison will remain challenging until there is national and ultimately global standardisation on frameworks and metrics.

From a qualitative perspective we note the prevalence of regions and cities showing circular economy leadership is increasing in Australia. Examples of prominent actors include the Hunter Joint

Organisation (Hunter Region) in NSW, Cities of Bendigo and Ballarat in regional Victoria and urban Councils with strong grassroots programs such as the City of Yarra.

We note the relative maturity of the three Councils, each with existing sustainability focussed strategies and plans and circular economy aspects within the procurement policy. Glen Eira Council also has a framework of circular economy indicators and metrics which could inform work on measures planned by both Stonnington and Boroondara Council. This existing foundation, in conjunction with the commitment to pursue circularity, puts the Councils in a strong position to work towards a circular economy.

7. Conclusion and recommendations

To transition to a circular economy, systemic change is needed across all sectors of the economy, with governments, businesses and communities all playing an important role. Locally, much work has commenced to boost circularity within local government, enabled in part by state policy settings as well as commitment by councils to address climate change and unsustainable resource use. As a result, a window of opportunity exists for councils to demonstrate leadership in the pursuit of circularity.

We found the three Councils examined in this project have existing sustainability-focussed strategies and plans that include varying levels of focus on circular economy, the most comprehensive being that of Glen Eira Council, which formalised its Circular Economy Plan in late 2022. The existing plans provide a strong foundation for each council to build upon in the journey towards a circular economy.

The MFA is one input that the Councils can use to inform priorities and decisions on their circular journey. This study found that data was limited at the local level, especially for C&I and C&D, but despite this lack of data, the modelling framework provides a foundation for future data analysis and provides indicative estimates to inform the Councils priorities and planning.

Key materials

The MFA identified organics then plastics as the two highest priority materials for action, followed by paper and cardboard, e-waste and textiles. For the five key materials the C&I waste stream generates the largest quantity of material for each Council which validates the focus on businesses for circular economy opportunities. The MSW stream is not discounted, with significant quantities of materials generated and opportunity to increase diversion of material from landfill. We note the actions to achieve interventions for materials can be overlapping for residents and business so both streams were considered relevant. The C&D stream was less important in this project because, based on the MFA/MCA method used, the building and demolition materials were not ranked in the top five key materials.

Opportunities (interventions and actions)

Notwithstanding that the MCA incorporated a waste hierarchy score, reducing material use through avoidance or 'doing without' is generally a preferred approach and, where relevant the principle of avoidance underpinned the proposed actions.

Thirty-one actions were identified for the top three ranking interventions across the 16 material types, which remained after screening. Six of these actions relate to four interventions which we identify as foundational for the Councils. They are:

- Integrate circular economy into council policies and strategies.
- Create metrics and targets and track progress towards a circular economy.
- Educate departments across LGAs on the principles of the circular economy.
- Council communication program to demonstrate the paradigm shift to a circular economy.

The four foundational interventions should apply irrespective of material type and for this reason, we recommend prioritising the related actions as essential activities.

The Councils desire an evidence-based approach to creation of circular projects. While not all things can be easily measured, it is extraordinarily difficult to chart progress, and provide an impetus to drive a meaningful shift in circular economy outcomes without an appropriate measurement framework and relevant data. The collection and management of data can however easily become overwhelming. We recommend the Councils carefully consider fit-for-purpose metrics, include all parts of Council in the process, and collaborate across councils for shared learning. To drive a systemic change the Councils will need all departments to understand the principles of a circular economy to help them identify intervention points across the LGA.

The remaining 25 actions are spread across the five material categories with focus on specific material types as informed by the MCA. The proposed action plans provide the Councils with priorities for each of the five materials, but noting the MCA is a filter only, specific projects/programs should be subject to their own detailed evaluation. Notwithstanding this, we recommend the Councils prioritise action on organics and plastics as the two highest ranked materials based on environmental, economic and social criteria.

References

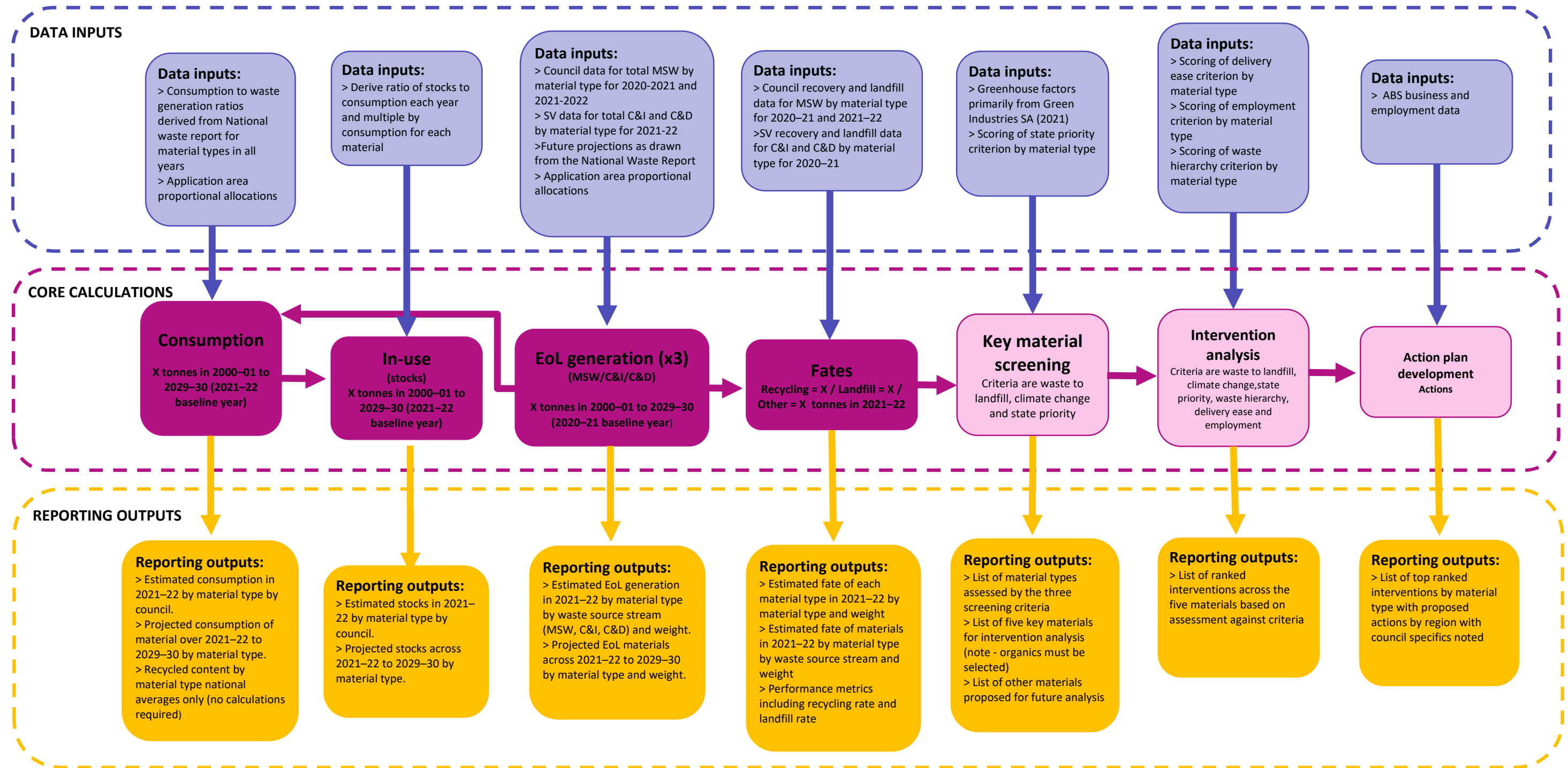
- ABS (Australian Bureau of Statistics) (2022a) *Boroondara 2021 Census All persons QuickStats*, online at <https://abs.gov.au/census/find-census-data/quickstats/2021/LGA21110>, accessed 14 October 2022.
- ABS (Australian Bureau of Statistics) (2022b) *Glen Eira 2021 Census All persons QuickStats*, online at <https://abs.gov.au/census/find-census-data/quickstats/2021/LGA22310>, accessed 14 October 2022.
- ABS (Australian Bureau of Statistics) (2022c) *Stonnington 2021 Census All persons QuickStats*, online at <https://abs.gov.au/census/find-census-data/quickstats/2021/LGA26350>, accessed 14 October 2022.
- ACE Hub (Australian Circular Economy Hub) (2022a) *Measuring the circular economy: An Australian Perspective*, online at <https://acehub.org.au/knowledge-hub/research/measuring-the-circular-economy-an-australian-perspective>, accessed 13 December 2022.
- ACE Hub (Australian Circular Economy Hub) (2022b) *State of circularity in Australia: Perspectives from the field*, online at <https://acehub.org.au/documents/state-of-circularity-in-australia-perspectives-from-the-field>, accessed 24 November 2022.
- ASPIRE website (n.d.) Various pages, <https://aspimes.com/>, accessed 13 January 2023.
- B-Alternative (2022), *Impact Report FY2021-22*, online at https://www.b-alternative.com/files/uqdc4c0b1_f23037bda0584fe19d889d3f50f9ba0b.pdf, accessed 12 December 2022).
- Blue Environment (2020) *Australian National Waste Report 2020*, prepared for the Australian Government Department of Climate Change, Energy, the Environment and Water (DCCEEW).
- Blue Environment (2021) *Australian Standard for Waste and Resource Recovery Data and Reporting*, prepared for the DCCEEW, online at <https://www.dcceew.gov.au/environment/protection/waste/publications/national-standard-waste-and-resource-recovery-data-and-reporting>.
- Blue Environment (2022a) *National Waste Reporting Tool 2020-21*, prepared for DCCEEW, online at <https://www.dcceew.gov.au/environment/protection/waste/national-waste-reports/2022>.
- Blue Environment (2022b) *National Waste Reporting Tool 2019-20*, prepared for DCCEEW, online at <https://www.dcceew.gov.au/environment/protection/waste/national-waste-reports/2022>.
- Blue Environment (2022c) *Australian Plastics Flows and Fates Study 2020-21 - National Report*, (unpublished), prepared for DCCEEW.
- Blue Environment (2022d) MS Excel model Supporting MS Excel MFA modelling for the Material flow analysis of remote and regional Australia report (2022) – Workbooks prepared by Blue Environment on behalf of the Department of Agriculture, Water and the Environment.
- Bontinck PA., Bricout JK, Grant TF and Legoe G (2021) *E-product stewardship in Australia: Evidence report* [7075KB], prepared for the Australian Government Department of Agriculture, Water and the Environment, online at <https://www.dcceew.gov.au/sites/default/files/env/pages/d347d42b-d755-481b-bc38-71683b5d1958/files/e-stewardship-evidence-report-2021.pdf>, accessed 16 January 2023.
- Brisbane City Council (2022) *Become a master composter website*, <https://www.brisbane.qld.gov.au/clean-and-green/green-home-and-community/sustainable-gardening/compost-and-food-waste-recycling/become-a-master-composter>, accessed 12 December 2022

- CERES website (n.d.) Various pages, <https://ceres.org.au/ceres-fair-wood/>, accessed 13 January 2023.
- Circle Economy (2022) *The Circularity Gap Report 2022*, online at <https://www.circularity-gap.world/2022#Download-the-report>, accessed 13 December 2022.
- Cleanaway (2022) Qenos and Cleanaway Plastic-to-Plastic Advanced Recycling feasibility study (news article), online at <https://www.cleanaway.com.au/sustainable-future/advanced-recycling-study/>, accessed 13 January 2022.
- Commonwealth Scientific and Industrial Research Organisation (CSIRO) (2021) *National circular economy roadmap for plastics, glass, paper and tyres*, online at <https://www.csiro.au/en/research/natural-environment/circular-economy>, accessed 13 January 2023.
- Compost Connect Website (n.d) Various pages, <https://www.compostconnect.org/>, accessed 12 December 2022.
- Curby website, (n.d.) Various pages, <https://www.curbyit.com/softplastics/>, accessed 13 January 2023.
- DCCEEW (Department of Climate Change, Energy, the Environment and Water) website (n.d.) Ministers priority list 2022-23, <https://www.dcceew.gov.au/environment/protection/waste/product-stewardship/ministers-priority-list/2022-23#endoflife-tyres>, accessed 13 January 2023.
- DELWP (Department of the Environment, Land, Water and Planning [now the Department of Energy, Environment and Climate Action] 2020, *Recycling Victoria, A New Economy*, online at <https://www.vic.gov.au/victorias-plan-circular-economy>, accessed 14 October 2022.
- Economy.ID (2022a) *City of Boroondara economic profile*, online at <https://economy.id.com.au/boroondara/>, accessed 13 October 2022.
- Economy.ID (2022b) *City of Glen Eira economic profile*, online at <https://economy.id.com.au/glen-eira/>, accessed 13 October 2022.
- Economy.ID (2022c) *City of Stonnington economic profile*, online at <https://economy.id.com.au/stonnington/>, accessed 13 October 2022.
- First Person Consulting (2021) *Waste audit analysis - hospitality and food retail sector*, prepared for SV and MWRRG.
- Green My Plate website, (n.d.) Various pages online at <https://www.greenmyplate.com.au/>, accessed on 13 February 2023.
- Greencollect website (n.d.) Various pages, accessed 13 January 2023.
- Infrastructure Australia. (2021). *Guide to multi-criteria analysis - Technical guide of the Assessment Framework*.
- Monash City Council (2022) Monash Delivers Soft Plastics Recycling Option for Residents (news article), online at <https://www.monash.vic.gov.au/About-Us/News/Monash-first-to-deliver-soft-plastics-recycling-option-for-residents-following-suspension-of-RedCycle>, accessed 13 January 2022.
- OECD (2021) *The OECD Inventory of Circular Economy Indicators*, OECD Publishing, Paris, online at <https://www.oecd.org/cfe/cities/InventoryCircularEconomyIndicators.pdf>, accessed 19 December 2022.
- Plastic Free Places website, (n.d.) Various pages online at <https://www.plasticfreeplaces.org/>, accessed 13 January 2022.

- RMIT University (2021) Soft plastic packaging recycled into sustainable concrete, online at <https://www.rmit.edu.au/news/all-news/2021/jan/soft-plastic-concrete>, accessed 12 December 2022.
- saveBOARD website (n.d.) Various pages, [saveBOARD](#), accessed 13 January 2023.
- Shiver Me Timbers website (n.d.) Various pages, <https://shivermetimbers.com.au/about-us/>, accessed 13 January 2023.
- Southern Cross Recycling Group Website (n.d) Various pages, <https://scrg.com.au/>, accessed 13 January 2023.
- Sustainability Victoria (2021) *Waste and recycling in Victoria - Local government waste services report, 2019–20*, Melbourne: Sustainability Victoria.
- Sustainability Victoria (2021) *Waste and recycling in Victoria - Recycling industry waste report, 2019–20*, Melbourne: Sustainability Victoria.
- Sustainability Victoria (2022a) *Recycled Products and Materials Procurment Toolkit for Local Government*, online at <https://www.sustainability.vic.gov.au/recycling-and-reducing-waste/for-councils-and-other-waste-recycling-operators/buy-recycled-service/procurement-toolkit>, accessed 13 January 2023.
- Sustainability Victoria (SV) (2022b) *Recovered Resources Market Bulletin (June 2022)*.
- Sustainable Resource Use (SRU) (2013) *Waste flows in the Victorian commercial and industrial sector* Melbourne: Sustainability Victoria.
- Unpackaged Eco website (n.d.) Various pages, <https://unpackaged.eco/>, accessed 13 January 2023.
- Urban salvage website (n.d.) Various pages, <https://www.urbansalvage.com.au/>, accessed 13 January 2023.
- Victorian Government (2020) Recycled First Policy, online at <https://bigbuild.vic.gov.au/about/ecologia/recycled-first-policy>, accessed 13 February 2023

Appendix A MFA framework and scope

A1. MFA framework



A2. MFA scope

A2.1 Materials scope

Table 21 Material categories and types

Type	Category
Food organics	Organics
Garden organics	Organics
Timber	Organics
Sawdust	Organics
Biosolids (non-contaminated)	Organics
Other organics	Organics
Mixed organics	Organics
Cardboard	Paper and cardboard
Polymer coated paperboard	Paper and cardboard
Office paper	Paper and cardboard
Newsprint & magazines	Paper and cardboard
PET (1)	Plastics
HDPE (2)	Plastics
PVC (3)	Plastics
LDPE (4)	Plastics
PP (5)	Plastics
PS (6)	Plastics
Other plastics (7)	Plastics
Textiles	Textiles, leather & rubber (excl. tyres)
Leather & rubber (excl. tyres)	Textiles, leather & rubber (excl. tyres)
Glass from food & beverage containers	Glass
Other glass	Glass
Asphalt	Building & demolition materials
Bricks, concrete & pavers	Building & demolition materials
Ceramics, tiles & pottery	Building & demolition materials
Plasterboard & cement sheeting	Building & demolition materials
Soil, sand and rock	Building & demolition materials
Rubble	Building & demolition materials
Iron and steel	Metals
Aluminium	Metals
Non-ferrous metals (ex. Aluminium)	Metals
Tyres (T140)	Tyres
E-waste	E-waste

A2.2 Application areas scope

MFA modelling considers application areas because materials as finished products are used differently across industries. There is significant variation for materials to be in the consumption (use) phase before they reach end-of-life and get sent into the waste stream. This is evident when comparing polymers used in single-use food packaging (for example in supermarkets), with the same plastic polymer that stays in use phase for a longer period, for example milk crates or pallets (reusable packaging), or in various types of pipes for underground (construction) or irrigation (agricultural) use. The lifespan of these products varies significantly, even though they are the same material.

Presented in the table below are the modelled application areas, which are the same as those adopted for the National Waste Report 2020 MFA modelling (Blue Environment, 2020).

Table 22 Modelled application areas (as defined in the 'use' process)

Application area	Comments
Agriculture	Agriculture, forestry and fishing related applications.
Built environment	Built environment (i.e., construction and demolition) related applications.
Electrical & electronic	Electrical and electronic products related applications.
Industrial	Industrial and manufacturing equipment/machinery, consumables and other inputs.
Packaging	Business-to-consumer (B2C) and business-to-business (B2B) packaging related applications.
Transport	Self-propelled vehicles, including those used in primary production and manufacturing.
Other application area	Other application related applications. Includes clothing, household goods and medical goods.
Unidentified applications	Unknown applications

A2.3 Timeline scope

The MFA baseline year is the financial year 2021-22. The underlying model was set up with a larger time boundary of -20yrs and +10 years from the baseline year to support the required stocks modelling.

The modelling period is wider than is minimally necessary for the material groups modelled to ensure good model coverage into historical stocks, particular in the built environment, and the ongoing use of some of the materials in long-lived applications, again primarily in the built environment.

In other words, a time range is used to establish the data for how materials are used in society. The stocks for example have an age profile as materials can be in use for quite long periods before reaching EoL but these still need to be accounted for.

A2.4 MFA indicators

The circular economy indicators developed through the MFA were anticipated to be recycled content, recycling rate and landfill rate. Table 23 sets out definitions of these MFA output metrics and what they measure. We found insufficient information on the recycled content of materials into consumption. This should be considered in further iterations of this type of project.

Table 23 MFA system performance metrics

Metric	Definition	Measures
Recycled content	Secondary sourced material divided by consumption.	Performance of the manufacturing system in utilising recycled materials.
Recycling rate	Materials recycled back to local or overseas manufacturing divided by material entering the waste system (excluding materials sent to energy recovery).	Performance of the system in recycling end-of-life materials.
Landfill rate	Materials sent to landfill divided by materials entering the waste system.	Performance of the system in generating material losses to landfill.

A3. MCA lists

Table 24 *Intervention list adopted for the project*

Intervention stream	Intervention
Council policy and regulation	Use council planning, regulation and approval frameworks for opportunities that require sustainable development and circular design.
Council policy and regulation	Integrate circular economy into council policies and strategies.
Council procurement	Council procurement of recovered materials to provide significant and reliable end markets.
Council procurement	Council sourcing of products (services) to achieve a higher order end of life fate.
Council support	Establish council run shared services for commonly used items.
Council support	Create incentives and provide support to improve circular economy outcomes.
Council support	Advocacy to State and National government to improve circular economy outcomes.
Data	Create metrics and targets and track progress towards a circular economy.
Diversion of materials	Increase recovery of materials as a resource (e.g. maximise recycling and reduce contamination).
Knowledge and capability building	Educate departments across LGAs on the principles of the circular economy.
Knowledge and capability building	Council communication program to demonstrate the paradigm shift to a circular economy.
Knowledge and capability building	Encourage consumers and businesses to purchase recycled content products.
Knowledge and capability building	Encourage consumers and businesses to choose products (or services) to achieve a higher order end of life fate.
Knowledge and capability building	Encourage consumers and business to engage with product stewardship schemes.
Innovation, research and pilots	Conduct research on ways to address local barriers to businesses and community implementing circular economy practices.
Innovation, research and pilots	Partner with major waste generators to avoid and reduce waste.
Innovation, research and pilots	Demonstration trials of any type and at any stage of material/product lifecycles to improve waste hierarchy outcomes.

The following six tables provide the MCA scoring criteria.

Table 25 MCA scoring, environmental, waste to landfill

Parameter description	Label	Value	Unit
Significant potential for reductions in waste to landfill from the base case (do nothing).	High potential for reductions	5	Ordinal scale data
Moderate potential for reductions in waste to landfill from the base case (do nothing).	Moderate potential for reductions	4	Ordinal scale data
Small or neutral potential for reductions in waste to landfill from the base case (do nothing).	Small or neutral potential for reductions	3	Ordinal scale data
Moderate potential for increases in waste to landfill from the base case (do nothing).	Moderate potential for increases	2	Ordinal scale data
High potential for increases in waste to landfill from the base case (do nothing).	High potential for increases	1	Ordinal scale data

Table 26 MCA scoring, environmental, climate change

Parameter description	Label	Value	Unit
Very high potential for reductions in greenhouse gas emissions from the base case (do nothing).	Very high potential for reductions	5	Ordinal scale data
High potential for reductions in greenhouse gas emissions from the base case (do nothing).	High potential for reductions	4	Ordinal scale data
Moderate potential for reductions in greenhouse gas emissions from the base case (do nothing).	Moderate potential for reductions	3	Ordinal scale data
Low potential for reductions in greenhouse gas emissions from the base case (do nothing).	Low potential for reductions	2	Ordinal scale data
Neutral potential for reductions in greenhouse gas emissions from the base case (do nothing).	Neutral potential for reductions	1	Ordinal scale data

Table 27 MCA scoring, environmental/economic/social, state priority

Parameter description	Label	Value	Unit
SV priority material with demonstrated need for increased intervention.	Very high priority	5	Ordinal scale data
SV emerging priority material or priority material with some existing or planned intervention.	High priority	4	Ordinal scale data
SV priority material with mature existing intervention.	Medium priority	3	Ordinal scale data
Material with potential to become SV priority in the future.	Low priority	2	Ordinal scale data
Material unlikely to become SV priority.	Very low priority	1	Ordinal scale data

Table 28 MCA scoring, environmental, waste hierarchy

Parameter description	Label	Value	Unit
Intervention has an avoidance or reuse position on the waste hierarchy, in relation to the end-market of the majority of the material that is impacted.	Avoidance or reuse	5	Ordinal scale data
Intervention has a material recycling (virgin competing) position on the waste hierarchy, in relation to the end-market of the majority of the material that is impacted. The key attribute of this criterion score being the displacement (competition with) virgin resource extraction.	Material recycling (virgin competing)	4	Ordinal scale data
Intervention has a material recycling (non-virgin competing) position on the waste hierarchy, in relation to the end-market of the majority of the material that is impacted. The key attribute of this criterion score being that the recycled materials are typically substituting for (competing with) materials other than the original high quality virgin materials.	Material recycling (non-virgin competing)	3	Ordinal scale data
Intervention has an energy recovery position on the waste hierarchy, in relation to the end-market of the majority of the material that is impacted.	Energy recovery	2	Ordinal scale data
Intervention has a landfill (including waste treatment/stabilisation and incineration) position on the waste hierarchy, in relation to the end-market of the majority of the material that is impacted.	Landfill or incineration	1	Ordinal scale data
Intervention is not applicable to this criterion.	Not applicable	3	Ordinal scale data

Table 29 MCA scoring, social, employment

Parameter description	Label	Value	Unit
Potential to create circular economy related long-term, short-term and local employment opportunities across the supply chain (over 10 in total).	Very good performance	5	Ordinal scale data
Potential to create circular economy related long-term, short-term and local employment opportunities across the supply chain (over 5 in total).	Good performance	4	Ordinal scale data
Potential to create some circular economy related long-term employment opportunities and short term employment opportunities across the supply chain.	Fair performance	3	Ordinal scale data
Neutral potential to create any circular economy related long-term employment opportunities, but with potential to create some short term employment opportunities in the development phase.	Neutral performance	2	Ordinal scale data
Potential to reduce employment opportunities.	Poor performance	1	Ordinal scale data
Intervention is not applicable to this criterion.	Not applicable	3	Ordinal scale data

Table 30 MCA scoring, technical, delivery ease

Parameter description	Label	Value	Unit
Program/project has demonstrated a very good ease of delivery considering cost to implement, typical capabilities of a council and existing opportunities for action.	Very good ease	5	Ordinal scale data
Program/project has demonstrated a good ease of delivery considering cost to implement, typical capabilities of a council and existing opportunities for action.	Good ease	4	Ordinal scale data
Program/project has demonstrated a fair ease of delivery considering cost to implement, typical capabilities of a council and existing opportunities for action.	Fair ease	3	Ordinal scale data
Program/project has demonstrated a poor ease of delivery considering cost to implement, typical capabilities of a council and existing opportunities for action.	Poor ease	2	Ordinal scale data
Program/project has demonstrated a very poor ease of delivery considering cost to implement, typical capabilities of a council and existing opportunities for action.	Very poor ease	1	Ordinal scale data
Intervention is not applicable to this criterion.	Not applicable	3	Ordinal scale data

Appendix B Stakeholder consultation

B1. Stakeholder consultation notes

Organisation	Interviewee	Council	Purpose	Key takeaways
Government				
Recycling Victoria	Luke Richmond <i>Team Leader, Data Analysis Data, Intelligence & Information Sharing</i>	State government	Identify data gaps in state and local government data, and views on priority materials.	- RV uses state population data to determine proportion of Victorian C&D and C&I waste generation and recycling. - Priority materials are consistent with SV funding rounds for infrastructure (organics, plastics, tyres, paper & cardboard). - RV is exploring circular economy metrics at state level
Sustainability Victoria	Florian van den Corput <i>Senior Advisor Circular Economy Strategic Foresight & Research</i>	State government	Background information on state circular economy practices and SV circular economy metrics framework.	- A draft framework for circular indicators and metrics in accordance with the State policy commitment to expand Victoria's waste data systems is expected to be finalised in early 2023. - RV want to localise information to help councils use baseline.
Academia/major waste generator				
Monash University	Glen Croy <i>Associate Professor, Department of Management, Monash Business School</i>	Glen Eira	As a local academic institution, discuss circular economy research and successful implementation techniques.	- Create awareness of existing circular economy opportunities and success stories, create accessible path for businesses to start circular economy journey. - Monitor waste composition, streams and destinations to identify if a waste output can be an input for another business. - Be aware of suppliers and determine supply chains to identify where these can align with circular economy values. - Increase circular economy by council procurement and incentives for purchasing recycled material/products, B2B facilitation. - Very interested in further engagement with councils on circular economy.
Swinburne University	Deborah Saltmarsh <i>Contracts Supervisor</i>	Boroondara	Discuss waste management and challenges from the perspective of a large organisation, and academics in the circular economy space	- Swinburne have an advanced waste management configuration compared to other organisations interviewed. Internal circular economy initiatives include: - E-waste

Organisation	Interviewee	Council	Purpose	Key takeaways
				– Coffee cups through Closed Loop – Furniture (previously through Green Collect, but were priced out and now looking for another vendor). • Even with advanced waste configuration the majority of waste is disposed to landfill. At Hawthorn campus, the largest, data for 2022 indicated 80% waste to landfill with collection of 10% cardboard/paper, 5% commingled, 4% soil and <1% food organics. • While fixed budgets can be a challenge, the biggest issue for waste management is space. • Key academics at Swinburne in the circular economy space are Gavin Melles and Anastassija (Stacey) Konash.
Major waste generator				
Alfred Caulfield Hospital	Samantha Conole <i>Food Services & Ward Support Co-ordinator</i>	Glen Eira	Understand waste types, generation, management, challenges and opportunities in a medical setting.	• Waste management configuration: garbage, commingled recycling, organics, paper & cardboard, and medical waste. • Introduced separate organics bin in the kitchen for food waste in 2021. • The highest waste material volume is single use PPE (masks, rubber gloves, disposable gowns), which cannot be recycled or reused. • Currently recycle E-waste like batteries (via Cleanaway Daniels) and printer cartridges (via Lexmark). • Interest in participating in circular economy initiatives with Council.
Chadstone shopping centre	Simone De Laney <i>Sustainable Supply Chain & Development Manager</i>	Stonnington	Understand waste types, generation, management, and challenges and opportunities for circular economy with a key facility in the region.	• Waste management configuration: garbage, commingled recycling, organics, paper & cardboard back of house, with only garbage and commingled available to shopping centre patrons. Major stores (Coles, Aldi, Woolworths) attend to their own waste, water and energy needs. • Developing a circular economy strategy and are very interested in circular economy initiatives or pilot programs with councils.

Organisation	Interviewee	Council	Purpose	Key takeaways
				- Suggest including sustainability and circular economy aspects within development applications to persuade executives of its importance. - Future plans for mixed use spaces, with leased office spaces and a hotel. - Shop fit-outs are a unique and major waste material.
Thomas Damm Catering	Thomas Damm <i>Owner & member of Elsternwick Traders Association</i>	Glen Eira	Understand the waste types, generation, management, and challenges and opportunities for circular economy in the food sector.	- Minimal food waste, conscious of this in the kitchen and leftover food from café and catering events is given to staff. - Participates in Glen Eira kerbside recycling collections. - Previously participated in ground coffee collection, but the price was too high. - Would like to see FOGO for commercial properties as part of council offerings, as well as free cardboard collection for members of main street and a soft plastics collection.
Other				
Rawtec	Kat Heinrich <i>Director & Associate Consultant</i>	Consulting	Insights into state and national circular economy metrics.	Different types of indicators: - Headline: approximately 9% circular (global indicator) - Transition: - different parts of economy, performance, focus - track willingness to move from linear to circular - consumer surveys, kerbside/hard waste data (inverse metric) - aspirational (lifespan of fridge, clothing, computer) - Impact: trade-offs, benefits and achieving goals - Need to identify what is most important to the stakeholder and measure this (i.e. tailor metrics to what is useful). - Focus on specific behaviours/activities.

Organisation	Interviewee	Council	Purpose	Key takeaways
Regional commerce group				
Carnegie Traders Association	Pauline Harris <i>Chair</i>	Glen Eira	Understand waste trends and challenges unique to the association, level of involvement in local circular economy initiatives and opportunities for increasing circular economy.	- Precinct is made up of mostly restaurants. - Major issues with garbage in laneways, causing a bad odour. - Lack of education amongst traders resulting high contamination, overflowing bins and limited interest in waste management/circular economy (no/limited recycling bins). - Language barriers are present in the precinct. - Require more support from council in communication and guidance for proper waste management, as well as a commercial bin service.
Glenferrie Traders Association	Sam Aldemir <i>Glenferrie Traders association president and Restaurant owner</i>	Boroondara	Understand waste trends and challenges unique to the association, level of involvement in local circular economy initiatives and opportunities for increasing circular economy.	- Businesses have a strong interest in circular economy, but minimal FOGO bins for commercial businesses. - Challenges include limited space (an issue for additional bins), contamination, late collections. - Suggest alternating collection days for different services due to limited space for bins. - FOGO should be weekly to reduce issues with rodents, this would mean garbage would only have to be collected fortnightly instead of weekly. Need a collection for soft plastics. - Opportunity for businesses to share bins (similar to Degraes St).
Waste manager				
Biogro	Sage Hahn <i>Operations Manager Victoria</i>	Boroondara Stonnington	Insight into organics recovery, receiving processor of council FOGO bins.	- Have the capability for commercial FOGO and direct food if contamination is managed. Biogro could work with council to set up commercial business FOGO configuration. - Looking to move into urban Melbourne market. - Suggest improving education, ensure caddies and liners are compliant, provide simple instructions to households. - Biogro could implement organics back into community spaces.

Organisation	Interviewee	Council	Purpose	Key takeaways
				Councils consolidating material at transfer station, to transport to Biogro, provides opportunity to analyse contamination and target mitigations.
Cleanaway	Melinda Lizza <i>Regional Manager - C&D Resource Recovery</i> Bhanu Sharma <i>Senior Business Development Manager</i>	Stonnington	As a local waste services provider, to understand local waste management, facility capacities, challenges with managing materials and opportunities for increasing recovery.	- As contamination of commingled recyclables is an issue at the MRFs, suggest implementing educational material such as QR codes with what can and cannot go in the recycling bin. - Council should buy back compost from organics collections and encourage residents to do the same. - Paper and cardboard can be difficult to find end markets for in large quantities, as there are few reprocessing plants in Australia, the material can be contaminated in commingled bins, and upcoming export bans means additional stock. - Commercial properties will have a garbage bin, and sometimes recycling (mostly made up of paper and cardboard), with very few opting for an organics bin.
Re.Group	Murray Sturt <i>Representative for Polytrade (now Re.Group)</i>	Glen Eira	As the receiving MRF of council kerbside commingled recycling, to understand local waste management, facility capacities, challenges with managing materials and opportunities for increasing recovery.	- Currently receive kerbside commingled recycling from seven councils. Baled mixed plastic received by local plastics reprocessor, paper & cardboard baled, glass is sorted and crushed at own beneficiation plant. - Paper & cardboard have the strongest end markets. - Active in other states for FOGO processing and CDS services. Looking to expand to Melbourne. Current tender for Vic CDS network provider. - Could potentially accept soft plastics in kerbside recycling if it was a system like Curby, as long as this financially supported the required increased staff, and there were sufficient end markets for stock. - Greatest challenge with municipal feedstock is contamination, especially around holiday seasons.

Appendix c Information review

C1 Information review

Our desktop review of available literature and information provided by the Councils informs the approach to the MFA and builds an understanding of the region to inform potential opportunities and priorities.

C1.1 Regulations, policies and plans

Relevant regulations, policies and plans were reviewed as part of Task 3. A synthesis of the results is outlined below in Table 31. It begins broadly covering the national political setting in the circular economy space, then Victorian and more specifically each council.

Table 31 Regulations, policies and plans relevant to project

Jurisdiction	Regulation, policy or plan	Description and key takeaways
National	National Waste Policy (2018) National Waste Policy Action Plan (2019)	The Waste Policy framework identifies five underpinning principles for waste management in a circular economy. It poses increased access to resource recovery, waste management infrastructure and capacity building in remote and regional areas. The Action Plan implements the Waste Policy with targets and actions to 2030. This includes; national packaging targets, impediments to circular economy, export waste restrictions, waste generation reduction, increased resource recovery, increased use of recycled content, phase out of problematic single use plastics, reduction in organic waste to landfill, greater public data availability and export waste restrictions (implemented for glass, plastics and tyres; to be implemented for mixed paper and cardboard starting July 2024).
	Environment Protection Act 2017 Circular Economy (Waste Reduction and Recycling) Act 2021	In addition to local government area waste plans, the major Victorian state legislation is within these Acts. The <i>Circular Economy (Waste Reduction and Recycling) Act 2021</i> sees the establishment of Recycling Victoria and implement the four-stream kerbside waste system (glass, recycling, MSW and organics) and container deposit scheme.
State	Recycling Victoria: A new economy (2020)	The policy and action plan aims to reduce waste and pollution, improve recycling and resource recovery, increase jobs, provide a stronger economy, and create a circular economy in Victoria. The Victorian Government will invest over \$300 million to implement the 10-year policy and action plan.
City of Stonnington	Sustainable environment strategy 2018-2023	The strategy will deliver on five strategic priority areas; climate change and energy, resources and waste management, integrated water management, urban environment, and education, engagement and collaboration. It includes procurement to build a circular economy. The Climate emergency action plan outlines how Council will delivery on these priority areas.

Jurisdiction	Regulation, policy or plan	Description and key takeaways
	Climate Emergency action plan 2021-2024	The plan is summarised by three strategic priorities; zero carbon Stonnington, thriving in a changing climate, and working together for change. Each priority is supported by a series of actions including contributing to a circular economy, for example incorporating recycled content into projects. The plan also commits to developing a circular economy strategy.
	Towards a circular economy: Our future waste strategy 2022–2025	Stonnington outlines three priorities; to avoid and reduce waste, reuse for as long as possible, and recovery and make waste history. These are supported by eight actions, in line with state policies like Recycling Victoria reforms, and transition to a circular economy.
	Procurement policy 2021-25	Framework for procurement of goods and services. The procurement policy links sustainability and value for money, with links to a circular economy.
	Plastic Free Policy and Sustainable Asset Policy	These policies were not provided during the information review, but the project team noted that they are in place for the council.
City of Boroondara	Boroondara Climate Action Plan 2021	The plan identifies targets and actions for council and the Boroondara municipality. Targets include council being net carbon neutral by 2022 Boroondara by 2035 and reduction in 2007–08 emissions of 100% by 2040 for the municipality. To achieve this, a set of actions are outlined which focus on energy efficiency and renewable energy, biodiversity and trees, water and waterways, transport and circular economy.
	Boroondara Waste Minimisation and Recycling Strategy (2017)	The strategy provides strategic direction for waste management. Key areas addressed are to reduce waste to landfill, reduce contamination in kerbside bins, and community education.
	Procurement policy 2021–25	Best practice framework for procurement of goods and services. When possible, Boroondara will preference local and sustainable products and services and apply an environmental sustainability test. Environmental procurement looks beyond upfront costs to consider entire life cycles, including; products that contain recycled material, water sensitivity, energy efficiency, biodiversity protection and circular economy.
City of Glen Eira	Our climate emergency response strategy 2021-2025	The strategy identifies 70 actions to deliver on six goals as well as four innovation areas to deliver community priorities, with the aim of climate change action. A key opportunity is growing the circular economy, through innovation and partnership with community, business and industry. Glen Eira will stimulate end markets using Council's purchasing power.
	Circular Economy plan 2022-2026	Glen Eira commits to transition to a circular economy. To do this, the plan identifies three pillars, design, share, regenerate, with supporting actions. Target performance areas are community knowledge, community waste and council waste. Note that the draft version was the subject of this review with the plan finalised during the project.
	Procurement policy 2021-25	Framework for contracting and procurement of goods and services. Procurement should consider recycled content, and a 10% higher purchase price is acceptable. The sustainable building and infrastructure policy states specifying recycled content in building, infrastructure, and construction materials wherever feasible.

C1.2 Case studies

Circular economy activity is gaining momentum as the need to decouple economic activity from the consumption of finite resources becomes more apparent. Extensive resources exist for nations, cities and businesses that are designed to enable, inspire and support transition to a circular economy. Globally, there are collaboratively created, online resources such as the [Ganbatte](#) website, which provides an excellent range of guidance, tools and case studies from all over the world. The [ACE Hub](#) and [Circular Economy Victoria](#) are local collaborations and designed to facilitate networks and knowledge-sharing, in part through locally focused case studies.

The following selection of case studies demonstrates some examples of successful circular economy initiatives relevant for materials of interest in this project. Additional examples have been considered throughout the project, particularly to inform development of actions for Councils.

Master Composter Course

Brisbane City Council offer a free two-day course for experienced composters. Participants use their skills by completing 20 hours of volunteer work in the community to receive their certificate at local community hubs. The course combines the science of composting with developing skills on business and employment, advocacy and networking.

Benefits to council and community include:

- community-based public education and behavioural change
- identify barriers to organics recovery
- reduce contamination in FOGO
- make social connections
- return on investment as the cost of running the course is far less than the 20+ hours of community work gained from course graduates
- many potential income-earning opportunities in composting graduates can explore, such as running workshops and providing in-home compost assistance.

This concept of offering local training can be applied to a variety of materials and activities. The additional benefit of developing skills on business and employment, advocacy and networking provides an opportunity to build awareness of circular economy thinking in an integrated way.

Product alternatives

A Victorian company [B-Alternative](#) consults with organisations to deliver low impact, financially viable alternatives for products. The company offers reusable crockery for events, environmentally stationery and office supplies for schools and workplaces, and organics removal and compostable packaging for hospitality venues. In the 2021–22 financial year, B-Alternative diverted 383 tonnes of organic waste from landfill, reducing carbon emissions by 2,681 tonnes CO₂^e and upcycled 126 tonnes of building materials. An example of this system in action is the *Riverboats Music Festival* planned for February 2023.

This company may be suitable for the Councils events and/or worth promoting to educational institutions and relevant businesses.

Post-consumer plastic

Replas, in conjunction with RMIT, developed Polyrok which is recycled plastic used as a substitute for mineral aggregate in concrete. Coles in Horsham installed a footpath using Polyrok in 2020, which uses about 95% RedCycle plastics. Testing has shown that the Polyrok does not release microplastics, makes the concrete more thermally efficient and is lighter and easier to use in construction. Polyrok has since been used in other regional Victorian councils and nationally.

We note the Councils interest in the EoL options for Polyrok. Depending on the polymers in use, it may be suitable for chemical recycling. The chemical recycling of plastics, also called advanced or feedstock recycling, consists of a diverse range of technologies which are mostly under development or early commercialisation. There are several prospective chemical recycling projects nationally and these will tend not to target the rigid consumer packaging generated by kerbside recycling but will target flexible plastic packaging collected from consumer sources and non-packaging sources of waste plastics.

Textiles

[Southern Cross Recycling Group](#) (SCR Group) collects unwanted clothing from national drop-off hubs to be sorted. Wearable clothing and accessories are sent to charities in Australia. This reduces the time needed for these charities to sort through the donations and reduces the financial burden of landfilling unwearable clothing. Since 2008, SCR Group reports to have avoided \$10.5 billion in landfill fees and diverted 149,000 tonnes of unwanted clothing from landfill. The 6% of clothing that is unwearable is turned into rags or recovered as alternative fuel. By continuing to have SCR Group hubs in each Council area this provides local drop off points for unwanted clothing.

ASPIRE

[ASPIRE](#) (Advisory System for Processing, Innovation and Resource Exchange) is an online marketplace for material resource exchange developed by CSIRO in a project led by the City of Kingston's Economic Development department and involving four Melbourne municipalities. It is targeted towards small to medium enterprises and its purpose is to match businesses with potential recyclers or reusers of waste and resources. The marketplace is accessible for any company within the four municipalities it was initially developed for (Kingston, Dandenong, Knox and Hume), as well as other councils who have registered for the service. Councils can subscribe for a paid membership to ASPIRE that allows businesses within the council free access to the platform.

ASPIRE states that over 1000 businesses are participants of the platform across 21 councils. The environmental and financial benefits for participating businesses in ASPIRE would vary on a case-to-case basis, depending on the businesses involved, types of materials exchanged, quantities, transport distances.

Such waste exchanges can act as good way to identify and introduce businesses that may benefit from exchanging wastes. However, at the local government level and for an urban council, similar outcomes might be achieved through local business networking events promoted by Council, or an advisory service provided by Council. Within the region potential opportunities for waste exchange include recovery of a wider range of C&I organics for composting and recovery of plastics and glass into road surfacing products.

C1.3 Baseline data compilation

Data collection involved a literature review of existing waste and material flows data, national, state and local regulations, policies and plans and circular economy best practices.

We compiled and analysed the available data from public, Council, and other government sources to establish a baseline and trends for the MFA. The sources used for baseline data compilation is outlined below in Table 32.

Table 32 Waste data sources for model

Data point	Reference	Data source
Kerbside bin waste composition (%)	Boroondara council	Boroondara Kerbside Bin Audit 2022 Report
	Glen Eira council	Glen Eira 2022 Waste Audit Report
	Stonnington council	Stonnington Council Waste Audit Report September 2021
Domestic waste quantities (tonnes)	All councils	Response to BE data request via email.
Proportional split of C&I and C&D to landfill and composition proportions (%)	Sustainability Victoria and Blue Environment	National waste reporting tool 2019-20 ¹
C&I and C&D to recycling composition (tonnes)	Sustainability Victoria	National waste reporting tool 2020-21 (unpublished)
Non-MSW waste quantities in Victoria (tonnes)	Sustainability Victoria	Recycling Industry Workbook 2019-20, Local Government Waste Services Workbook 2019-20 ²
Population	Australian Bureau of Statistics	2021 Census

¹ The 2019-20 Reporting Tool uses the most recent Victorian landfill data

² As of November 2022, 2020-21 data was unavailable. As such, published 2019-20 data assumed to be representative for use in calculations.

Waste services

Blue Environment reviewed available council waste services and collated key points in Table 33 below. For each council, the destination facility for kerbside services is located outside of the region. Kerbside hard waste collection (recycling and landfill) is available for each council, via online booking systems.

Table 33 *Kerbside services in place for each council*

Kerbside service		Stonnington	Boroondara	Glen Eira
Garbage	Bin size (L)	120	80/120/240	120/240
	Collection frequency	Weekly	Fortnightly	Fortnightly
	Requirement	Provided	Provided	Provided
	Contractor	In house	In house	Outsourced
Recycling	Bin size (L)	240	120/240	120/240
	Collection frequency	Fortnightly	Weekly	Fortnightly
	Requirement	Provided	Provided	Provided
	Contractor	Outsourced	Outsourced	Outsourced
FOGO	Bin size (L)	120/240	120/240	120/240
	Collection frequency	Fortnightly	Weekly	Weekly
	Requirement	Opt-in	Provided	Opt-in
	Contractor	In house	In house	Outsourced
Transfer station in LGA		Yes	Yes	No

Economic setting

The Cities of Stonnington, Boroondara and Glen Eira are in inner east Melbourne, and collectively contribute \$29.4 billion to Victoria's Gross Regional Product and supports 182,795 jobs (Economy.ID 2022a, b, c). A breakdown of these attributes for each council is shown in Table 34.

Table 34 *Demographic and economic overview for region in 2021*

Council	Population	Jobs supported	Gross Regional Product (million)
Stonnington	104,703	55,031	\$9.88
Boroondara	167,900	81,609	\$12.39
Glen Eira	148,908	46,155	\$7.17

Sources: ABS (2022 a, b, c), Economy.ID (2022 a, b, c)

The main industries located in the region are health care, professional services, retail trade, education, and construction. Each council has a mix of shopping strips or activity centres as well as larger businesses. The major waste producers and shopping hubs as described by each council are:

- **Stonnington** - Holmesglen TAFE, Chadstone shopping centre, five shopping precincts; Chapel Street, Glenferrie Road Malvern, High Street Armadale, Toorak Road South Yarra, Toorak Village.

- **Boroondara** - Swinburn University, Melbourne University, Epworth Hospital Camberwell, Epworth Hospital Hawthorn, Supermarkets Coles Head Office, Woolworths, IGA, Aldi, Bunnings, Venues: Hawthorn Arts Centre, Glenferrie Hotel, Sophia's Restaurant, markets including Camberwell Sunday and fresh food, Hawthorn makers, Boroondara farmers.
- **Glen Eira** - Caulfield Hospital, Caulfield Racecourse (seasonal), Moorabbin Hospital, Monash University, five shopping centres; Bentleigh shopping centre, Carnegie shopping centre, Elsternwick shopping centre, Glen Huntly shopping centre, Ormond shopping centre.

Table 35 lists the top four industry sectors for employment (FTE) in each council. The industrial profile and key business types, including typical waste and materials was considered during development of actions.

Table 35 Division level business numbers and full time employment (FTE), by council

Rank	Council					
	Stonnington		Boroondara		Glen Eira	
	Industry sector	FTE	Industry sector	FTE	Industry sector	FTE
1	Health Care & Social Assistance	10,454	Health Care and Social Assistance	11115	Health Care and Social Assistance	7864
2	Retail Trade	10,279	Professional, Scientific and Technical Services	10849	Education and Training	6035
3	Professional, Scientific & Technical Services	8,119	Education and Training	9653	Professional, Scientific and Technical Services	3389
4	Education and training	4,169	Retail Trade	6989	Construction	3322

The circular economy encompasses principles related to use and reuse of materials as well as economic elements, such as identifying collaborative opportunities for existing and new businesses to work together. This means it is important to understand a city's economic setting in the pursuit of circularity. The economic information for the region has been integrated into development of the action plans.

Appendix D MCA outcomes

D1 MCA outcomes

Table 36 Top 20 interventions across all materials compared by Council

Stonnington				Boroondara				Glen Eira			
Rank	Intervention	Stream	Material type	Rank	Intervention	Stream	Material type	Rank	Intervention	Stream	Material type
1	Increase recovery of materials as a resource (e.g. maximise recycling and reduce contamination).	Diversion of materials	PET (1)	1	Increase recovery of materials as a resource (e.g. maximise recycling and reduce contamination).	Diversion of materials	PET (1)	1	Increase recovery of materials as a resource (e.g. maximise recycling and reduce contamination).	Diversion of materials	PET (1)
2	Increase recovery of materials as a resource (e.g. maximise recycling and reduce contamination).	Diversion of materials	HDPE (2)	2	Encourage consumers and businesses to purchase recycled content products.	Knowledge and capability building	PET (1)	2	Encourage consumers and businesses to purchase recycled content products.	Knowledge and capability building	PET (1)
3	Encourage consumers and businesses to purchase recycled content products.	Knowledge and capability building	PET (1)	2	Create incentives and provide support to improve circular economy outcomes.	Council support	LDPE (4)	2	Create incentives and provide support to improve circular economy outcomes.	Council support	LDPE (4)
3	Create incentives and provide support to improve circular economy outcomes.	Council support	LDPE (4)	4	Increase recovery of materials as a resource (e.g. maximise recycling and reduce contamination).	Diversion of materials	HDPE (2)	4	Increase recovery of materials as a resource (e.g. maximise recycling and reduce contamination).	Diversion of materials	HDPE (2)
5	Council communication program to demonstrate the paradigm shift to a circular economy.	Knowledge and capability building	LDPE (4)	5	Council communication program to demonstrate the paradigm shift to a circular economy.	Knowledge and capability building	LDPE (4)	5	Council communication program to demonstrate the paradigm shift to a circular economy.	Knowledge and capability building	LDPE (4)
6	Encourage consumers and	Knowledge and	LDPE (4)	6	Encourage consumers and	Knowledge and	LDPE (4)	6	Encourage consumers and	Knowledge and	LDPE (4)

Stonnington				Boroondara				Glen Eira			
	businesses to purchase recycled content products.	capability building			businesses to purchase recycled content products.	capability building			businesses to purchase recycled content products.	capability building	
7	Council procurement of recovered materials to provide significant and reliable end markets.	Council procurement	Food organics	7	Council procurement of recovered materials to provide significant and reliable end markets.	Council procurement	Food organics	7	Council procurement of recovered materials to provide significant and reliable end markets.	Council procurement	Food organics
7	Council procurement of recovered materials to provide significant and reliable end markets.	Council procurement	Garden organics	7	Create incentives and provide support to improve circular economy outcomes.	Council support	PET (1)	7	Create incentives and provide support to improve circular economy outcomes.	Council support	PET (1)
7	Create incentives and provide support to improve circular economy outcomes.	Council support	PET (1)	7	Encourage consumers and businesses to choose products (or services) to achieve a higher order end of life fate.	Knowledge and capability building	PET (1)	7	Encourage consumers and businesses to choose products (or services) to achieve a higher order end of life fate.	Knowledge and capability building	PET (1)
7	Encourage consumers and businesses to choose products (or services) to achieve a higher order end of life fate.	Knowledge and capability building	PET (1)	7	Encourage consumers and businesses to purchase recycled content products.	Knowledge and capability building	PP (5)	7	Encourage consumers and businesses to purchase recycled content products.	Knowledge and capability building	PP (5)
7	Encourage consumers and businesses to purchase recycled content products.	Knowledge and capability building	HDPE (2)	11	Council communication program to demonstrate the paradigm shift to a circular economy.	Knowledge and capability building	PET (1)	11	Increase recovery of materials as a resource (e.g. maximise recycling and reduce contamination).	Diversion of materials	Office paper

Stonnington				Boroondara				Glen Eira			
12	Increase recovery of materials as a resource (e.g. maximise recycling and reduce contamination).	Diversion of materials	Office paper	12	Create incentives and provide support to improve circular economy outcomes.	Council support	Food organics	11	Council communication program to demonstrate the paradigm shift to a circular economy.	Knowledge and capability building	PET (1)
12	Council communication program to demonstrate the paradigm shift to a circular economy.	Knowledge and capability building	PET (1)	12	Council communication program to demonstrate the paradigm shift to a circular economy.	Knowledge and capability building	Food organics	13	Create incentives and provide support to improve circular economy outcomes.	Council support	Food organics
14	Create incentives and provide support to improve circular economy outcomes.	Council support	Food organics	12	Council procurement of recovered materials to provide significant and reliable end markets.	Council procurement	Garden organics	13	Council communication program to demonstrate the paradigm shift to a circular economy.	Knowledge and capability building	Food organics
14	Council communication program to demonstrate the paradigm shift to a circular economy.	Knowledge and capability building	Food organics	12	Encourage consumers and businesses to purchase recycled content products.	Knowledge and capability building	HDPE (2)	13	Council procurement of recovered materials to provide significant and reliable end markets.	Council procurement	Garden organics
14	Create incentives and provide support to improve circular economy outcomes.	Council support	Garden organics	12	Encourage consumers and businesses to choose products (or services) to achieve a higher order end of life fate.	Knowledge and capability building	LDPE (4)	13	Encourage consumers and businesses to purchase recycled content products.	Knowledge and capability building	HDPE (2)
14	Council communication program to demonstrate the paradigm shift to a	Knowledge and capability building	Garden organics	17	Council procurement of recovered materials to provide significant and reliable	Council procurement	Cardboard	13	Encourage consumers and businesses to choose products (or services) to achieve a	Knowledge and capability building	LDPE (4)

Stonnington				Boroondara				Glen Eira			
	circular economy.				end markets.				higher order end of life fate.		
14	Encourage consumers and businesses to choose products (or services) to achieve a higher order end of life fate.	Knowledge and capability building	LDPE (4)	17	Increase recovery of materials as a resource (e.g. maximise recycling and reduce contamination).	Diversion of materials	Cardboard	18	Council procurement of recovered materials to provide significant and reliable end markets.	Council procurement	Cardboard
14	Encourage consumers and businesses to purchase recycled content products.	Knowledge and capability building	PP (5)	17	Encourage consumers and businesses to purchase recycled content products.	Knowledge and capability building	Cardboard	18	Increase recovery of materials as a resource (e.g. maximise recycling and reduce contamination).	Diversion of materials	Cardboard
20	Council procurement of recovered materials to provide significant and reliable end markets.	Council procurement	Cardboard	17	Increase recovery of materials as a resource (e.g. maximise recycling and reduce contamination).	Diversion of materials	Newsprint & magazines	18	Encourage consumers and businesses to purchase recycled content products.	Knowledge and capability building	Cardboard

Table 37 Top 3 ranked interventions by material type (consistent by council)

Rank	Material type	Material group	Intervention	Stream
1	Food organics	Organics	Council procurement of recovered materials to provide significant and reliable end markets.	Council procurement
2	Food organics	Organics	Create incentives and provide support to improve circular economy outcomes.	Council support
2	Food organics	Organics	Council communication program to demonstrate the paradigm shift to a circular economy.	Knowledge and capability building
1	Garden organics	Organics	Council procurement of recovered materials to provide significant and reliable end markets.	Council procurement
2	Garden organics	Organics	Create incentives and provide support to improve circular economy outcomes.	Council support
2	Garden organics	Organics	Council communication program to demonstrate the paradigm shift to a circular economy.	Knowledge and capability building
1	Timber	Organics	Council communication program to demonstrate the paradigm shift to a circular economy.	Knowledge and capability building
2	Timber	Organics	Increase recovery of materials as a resource (e.g. maximise recycling and reduce contamination).	Diversion of materials
2	Timber	Organics	Encourage consumers and businesses to purchase recycled content products.	Knowledge and capability building
1	Cardboard	Paper & cardboard	Council procurement of recovered materials to provide significant and reliable end markets.	Council procurement
1	Cardboard	Paper & cardboard	Increase recovery of materials as a resource (e.g. maximise recycling and reduce contamination).	Diversion of materials
1	Cardboard	Paper & cardboard	Encourage consumers and businesses to purchase recycled content products.	Knowledge and capability building
1	Polymer coated paperboard	Paper & cardboard	Council communication program to demonstrate the paradigm shift to a circular economy.	Knowledge and capability building
2	Polymer coated paperboard	Paper & cardboard	Integrate circular economy into council policies and strategies.	Council policy and regulation
2	Polymer coated paperboard	Paper & cardboard	Advocacy to State and National government to improve circular economy outcomes.	Council support
2	Polymer coated paperboard	Paper & cardboard	Create metrics and targets to track progress towards a circular economy.	Data
2	Polymer coated paperboard	Paper & cardboard	Educate departments across LGAs on the principles of the circular economy.	Knowledge and capability building
1	Newsprint & magazines	Paper & cardboard	Increase recovery of materials as a resource (e.g. maximise recycling and reduce contamination).	Diversion of materials
2	Newsprint & magazines	Paper & cardboard	Council procurement of recovered materials to provide significant and reliable end markets.	Council procurement
3	Newsprint & magazines	Paper & cardboard	Council communication program to demonstrate the paradigm shift to a circular economy.	Knowledge and capability building
1	Office paper	Paper & cardboard	Increase recovery of materials as a resource (e.g. maximise recycling and reduce contamination).	Diversion of materials
2	Office paper	Paper & cardboard	Encourage consumers and businesses to purchase recycled content products.	Knowledge and capability building
3	Office paper	Paper & cardboard	Council procurement of recovered materials to provide significant and reliable end markets.	Council procurement
1	PET (1)	Plastics	Increase recovery of materials as a resource (e.g. maximise recycling and reduce contamination).	Diversion of materials

Rank	Material type	Material group	Intervention	Stream
2	PET (1)	Plastics	Encourage consumers and businesses to purchase recycled content products.	Knowledge and capability building
3	PET (1)	Plastics	Create incentives and provide support to improve circular economy outcomes.	Council support
3	PET (1)	Plastics	Encourage consumers and businesses to choose products (or services) to achieve a higher order end of life fate.	Knowledge and capability building
1	HDPE (2)	Plastics	Increase recovery of materials as a resource (e.g. maximise recycling and reduce contamination).	Diversion of materials
2	HDPE (2)	Plastics	Encourage consumers and businesses to purchase recycled content products.	Knowledge and capability building
3	HDPE (2)	Plastics	Create incentives and provide support to improve circular economy outcomes.	Council support
1	PVC (3)	Plastics	Council communication program to demonstrate the paradigm shift to a circular economy.	Knowledge and capability building
2	PVC (3)	Plastics	Integrate circular economy into council policies and strategies.	Council policy and regulation
2	PVC (3)	Plastics	Advocacy to State and National government to improve circular economy outcomes. (Note no action proposed for this material type and intervention combination, as we believe it less applicable for councils and low viability for practical influence.)	Council support
2	PVC (3)	Plastics	Create metrics and targets to track progress towards a circular economy.	Data
2	PVC (3)	Plastics	Educate departments across LGAs on the principles of the circular economy.	Knowledge and capability building
1	LDPE (4)	Plastics	Create incentives and provide support to improve circular economy outcomes.	Council support
2	LDPE (4)	Plastics	Council communication program to demonstrate the paradigm shift to a circular economy.	Knowledge and capability building
3	LDPE (4)	Plastics	Encourage consumers and businesses to purchase recycled content products.	Knowledge and capability building
1	PP (5)	Plastics	Encourage consumers and businesses to purchase recycled content products.	Knowledge and capability building
2	PP (5)	Plastics	Create incentives and provide support to improve circular economy outcomes.	Council support
3	PP (5)	Plastics	Council communication program to demonstrate the paradigm shift to a circular economy.	Knowledge and capability building
1	PS (6)	Plastics	Create incentives and provide support to improve circular economy outcomes.	Council support
2	PS (6)	Plastics	Council communication program to demonstrate the paradigm shift to a circular economy.	Knowledge and capability building
3	PS (6)	Plastics	Encourage consumers and businesses to purchase recycled content products.	Knowledge and capability building
1	Textiles	Textiles, leather & rubber	Council communication program to demonstrate the paradigm shift to a circular economy.	Knowledge and capability building
2	Textiles	Textiles, leather & rubber	Integrate circular economy into council policies and strategies.	Council policy and regulation

Rank	Material type	Material group	Intervention	Stream
2	Textiles	Textiles, leather & rubber	Create incentives and provide support to improve circular economy outcomes.	Council support
2	Textiles	Textiles, leather & rubber	Advocacy to State and National government to improve circular economy outcomes.	Council support
2	Textiles	Textiles, leather & rubber	Create metrics and targets to track progress towards a circular economy.	Data
2	Textiles	Textiles, leather & rubber	Educate departments across LGAs on the principles of the circular economy.	Knowledge and capability building
2	Textiles	Textiles, leather & rubber	Partner with major waste generators to avoid and reduce waste.	Innovation, research and pilots
1	Leather & rubber (excl. tyres)	Textiles, leather & rubber	Council communication program to demonstrate the paradigm shift to a circular economy.	Knowledge and capability building
2	Leather & rubber (excl. tyres)	Textiles, leather & rubber	Integrate circular economy into council policies and strategies.	Council policy and regulation
2	Leather & rubber (excl. tyres)	Textiles, leather & rubber	Advocacy to State and National government to improve circular economy outcomes.	Council support
2	Leather & rubber (excl. tyres)	Textiles, leather & rubber	Create metrics and targets to track progress towards a circular economy.	Data
2	Leather & rubber (excl. tyres)	Textiles, leather & rubber	Educate departments across LGAs on the principles of the circular economy.	Knowledge and capability building
1	E-waste	E-waste	Council communication program to demonstrate the paradigm shift to a circular economy.	Knowledge and capability building
2	E-waste	E-waste	Integrate circular economy into council policies and strategies.	Council procurement
2	E-waste	E-waste	Create incentives and provide support to improve circular economy outcomes.	Council policy and regulation
2	E-waste	E-waste	Advocacy to State and National government to improve circular economy outcomes.	Council support
2	E-waste	E-waste	Create metrics and targets to track progress towards a circular economy.	Council support
2	E-waste	E-waste	Educate departments across LGAs on the principles of the circular economy.	Data

Appendix E MFA outcomes

E1. MFA outcomes

This appendix contains some reporting outputs (from the body of the report) in a format separated by council for individual use.

Figure 13 EoL generation of key material types, by waste source stream (MSW, C&I, C&D) in Stonnington, 2021–22 (kt)

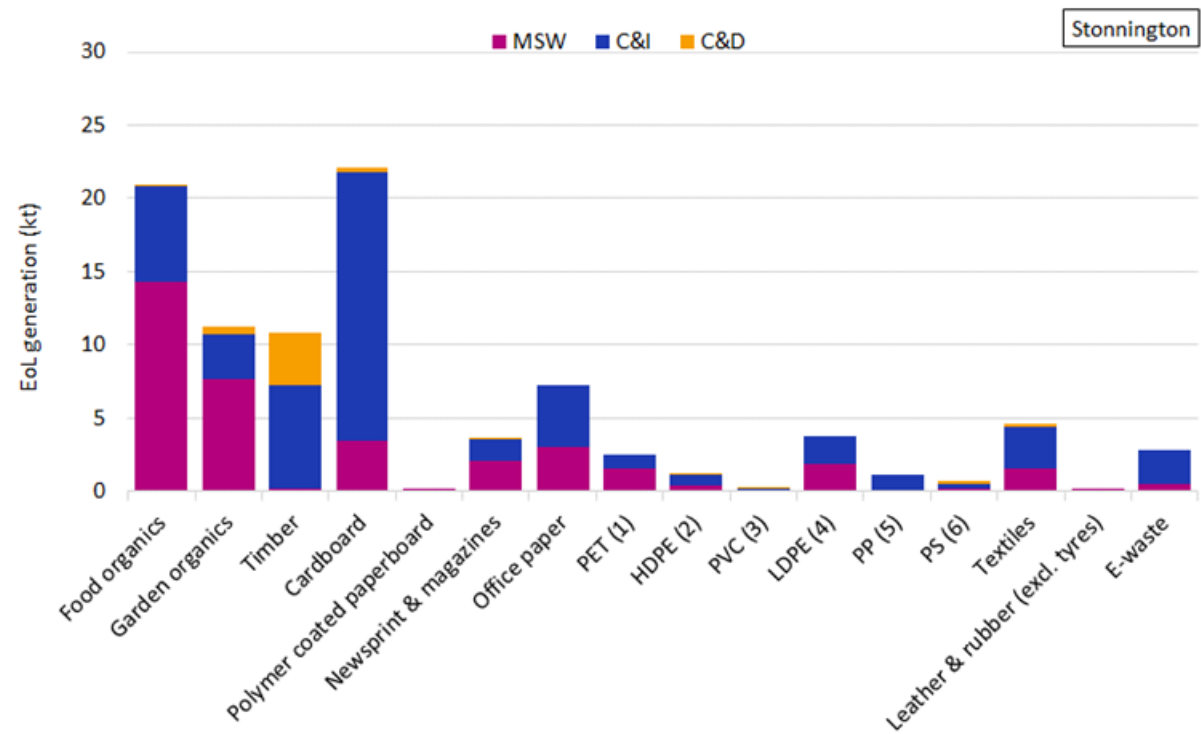


Figure 14 *EoL generation of key material types, by waste source stream (MSW, C&I, C&D) in Boroondara, 2021–22 (kt)*

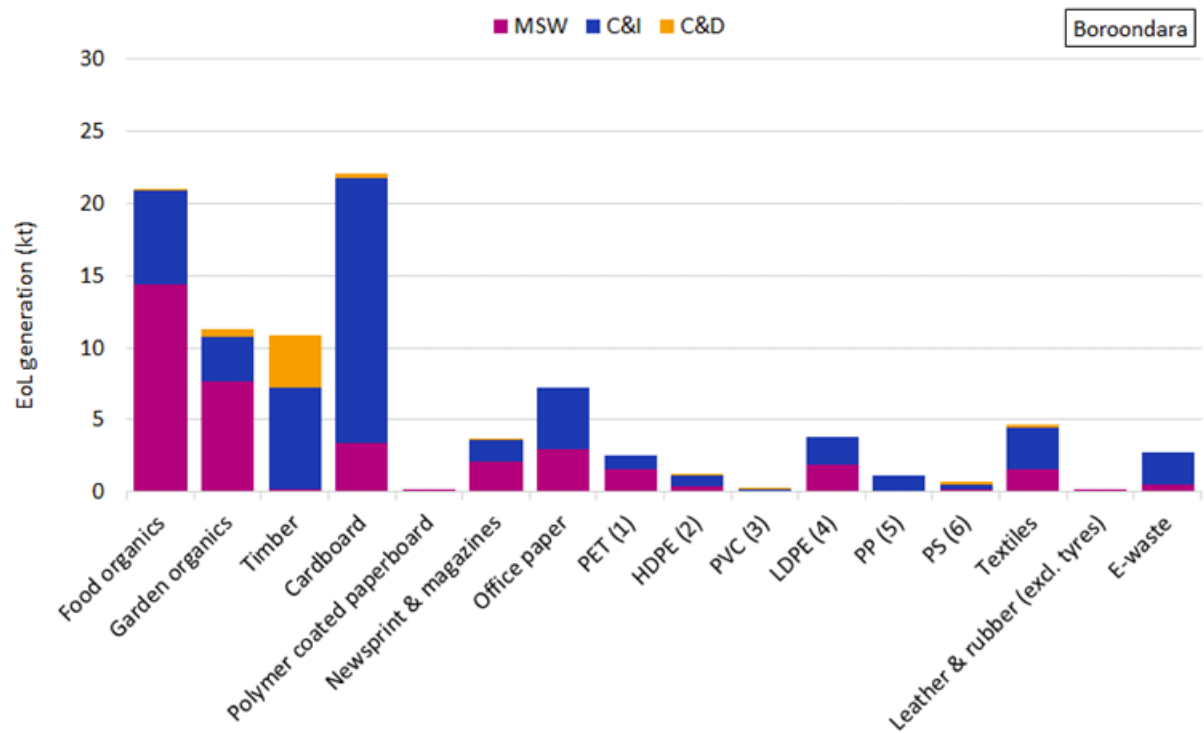


Figure 15 *EoL generation of key material types, by waste source stream (MSW, C&I, C&D) in Glen Eira, 2021–22 (kt)*

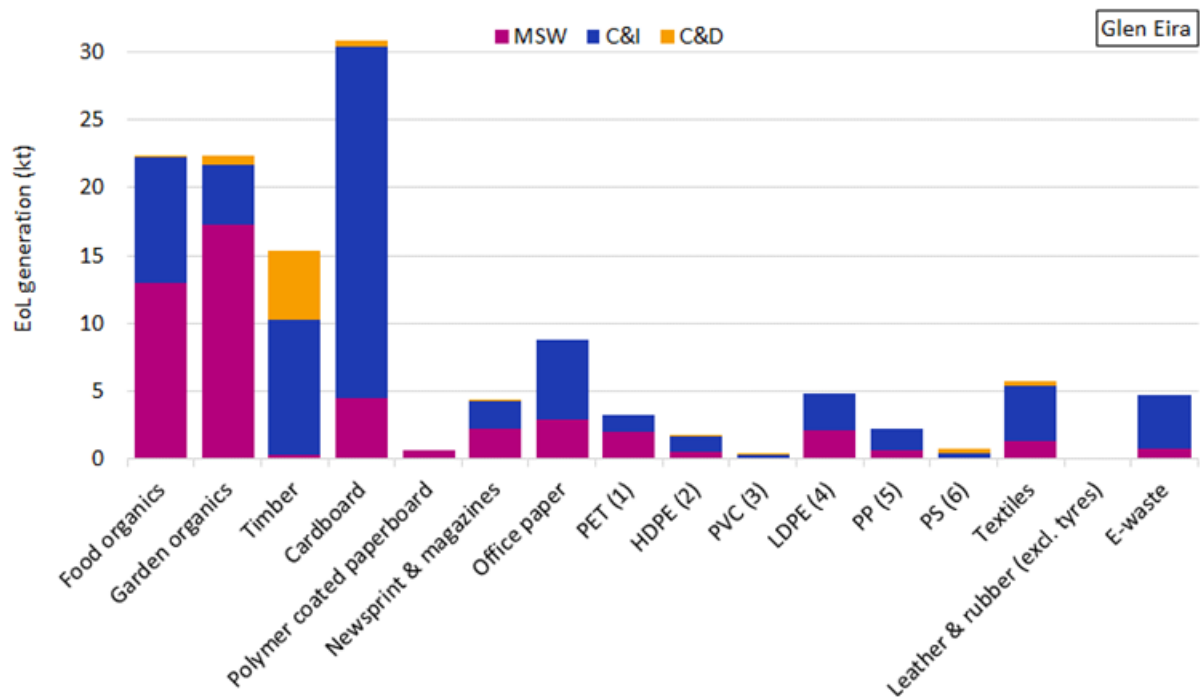


Figure 16 Fate of key material types in Stonnington, by recovery and disposal groupings, 2021-22 (kt)

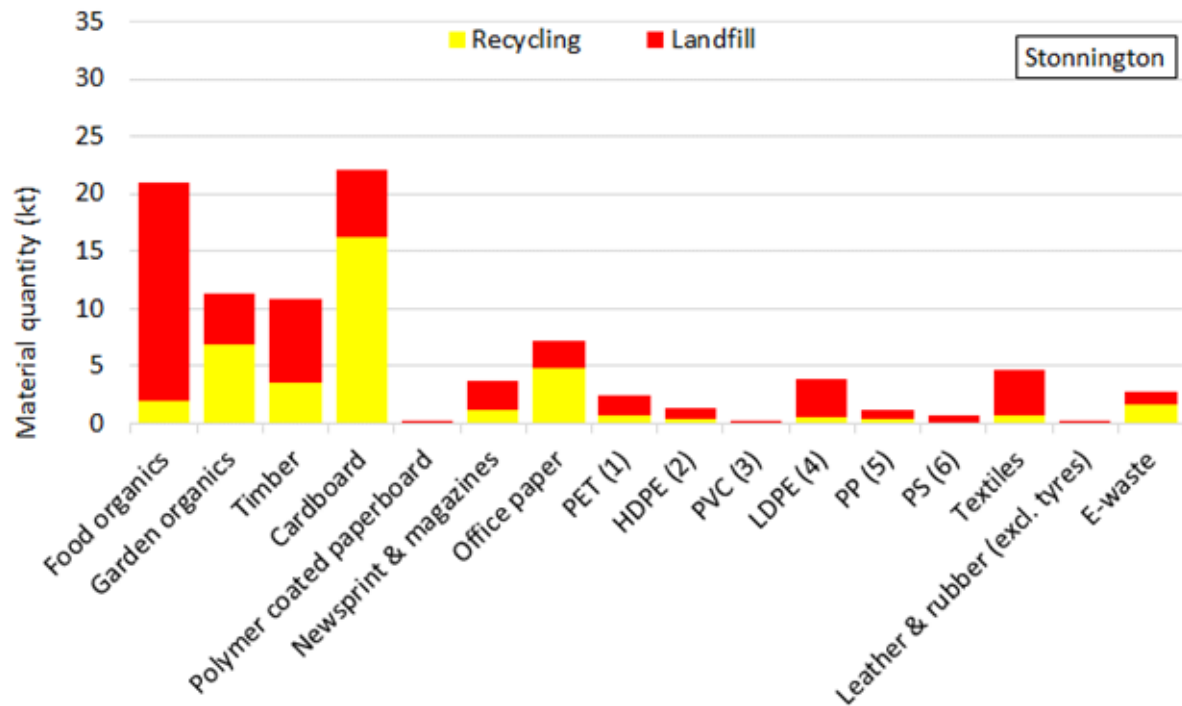


Figure 17 Fate of key material types in Boroondara, by recovery and disposal groupings, 2021-22 (kt)

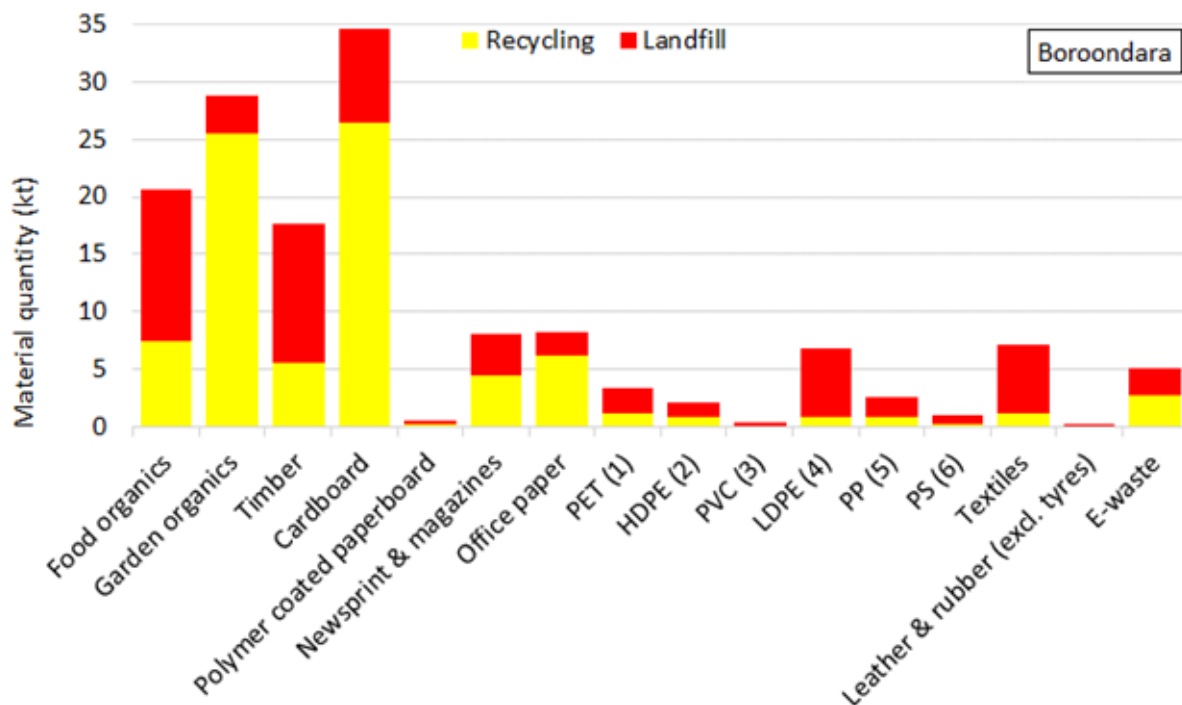


Figure 18 Fate of key material types in Glen Eira, by recovery and disposal groupings, 2021-22 (kt)

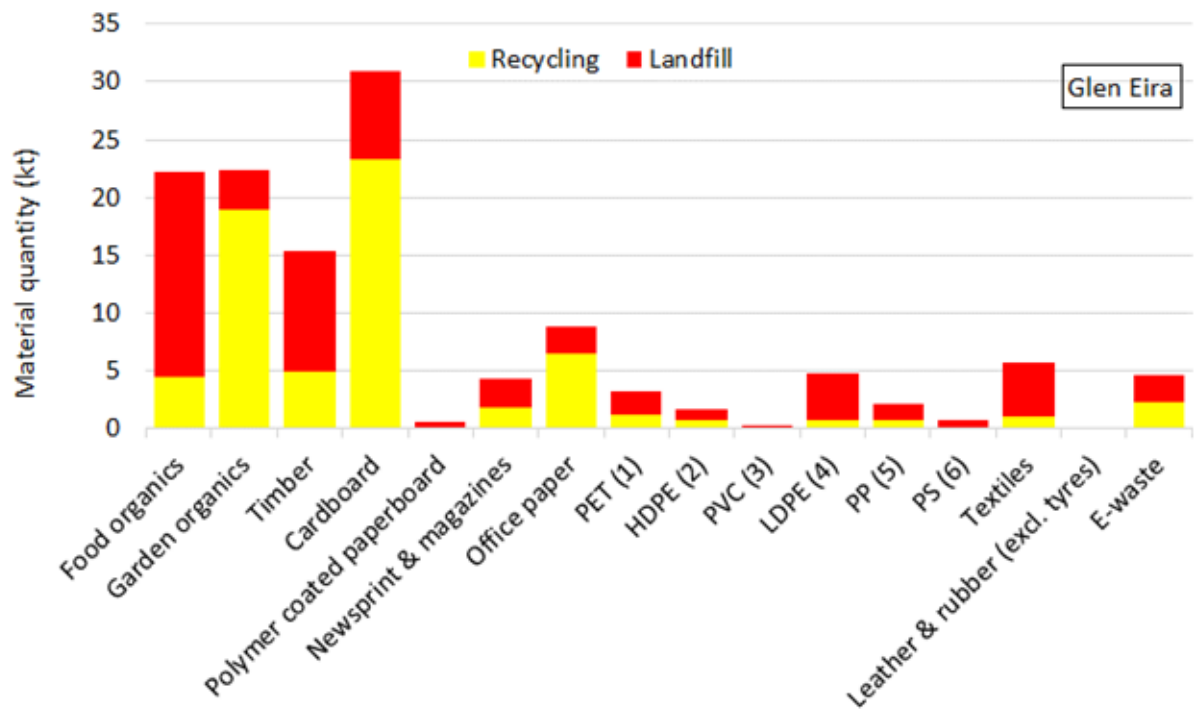


Table 38 Summary of material flows, for Stonnington, 2021–22 (kt or %)

Material category		MSW		C&I		C&D		All			
		Recycling	Landfill	Recycling	Landfill	Recycling	Landfill	Recycling	Landfill	Generation 2021–22	Recycling rate
Stonnington	Organics	5.6	16.7	4.9	11.8	1.7	2.5	12.2	30.9	43.0	28%
	Paper & cardboard	3.8	4.9	18.1	6.0	0.2	0.1	22.1	11.0	33.1	67%
	Plastics	0.6	3.5	1.3	3.9	0.0	0.3	1.9	7.7	9.6	20%
	Textiles, leather & rubber	0.0	1.8	0.7	2.2	0.0	0.2	0.7	4.2	4.9	15%
	E-waste	0.0	0.5	1.7	0.6	0.0	0.0	1.7	1.1	2.8	60%
	Total	9.9	27.4	26.7	24.4	2.0	3.1	38.6	54.9	93.5	41%

Table 39 Summary of material flows, for Boroondara, 2021–22 (kt or %)

Material category		MSW		C&I		C&D		All			
		Recycling	Landfill	Recycling	Landfill	Recycling	Landfill	Recycling	Landfill	Generation 2021–22	Recycling rate
Boroondara	Organics	28.1	5.9	7.9	18.8	2.7	3.9	38.6	28.6	67.2	57%
	Paper & cardboard	8.0	4.3	28.9	9.5	0.4	0.2	37.3	14.1	51.3	73%
	Plastics	1.7	5.6	2.0	6.3	0.1	0.5	3.9	12.3	16.2	24%
	Textiles, leather & rubber	0.0	2.4	1.1	3.5	0.0	0.3	1.1	6.1	7.3	16%
	E-waste	0.0	0.6	2.7	1.8	0.0	0.0	2.7	2.4	5.0	53%
	Total	37.8	18.8	42.7	39.8	3.1	4.9	83.6	63.5	147.1	57%

Table 40 Summary of material flows, for Glen Eira, 2021–22 (kt or %)

Material category		MSW		C&I		C&D		All			
		Recycling	Landfill	Recycling	Landfill	Recycling	Landfill	Recycling	Landfill	Generation 2021–22	Recycling rate
Glen Eira	Organics	19.0	11.6	7.0	16.7	2.4	3.5	28.3	31.7	60.1	47%
	Paper & cardboard	5.7	4.4	25.7	8.4	0.3	0.2	31.7	13.0	44.7	71%
	Plastics	1.7	3.6	1.8	5.5	0.1	0.4	3.6	9.6	13.2	27%
	Textiles, leather & rubber	0.0	1.3	1.0	3.1	0.0	0.3	1.0	4.7	5.7	18%
	E-waste	0.0	0.7	2.4	1.6	0.0	0.0	2.4	2.3	4.7	51%
	Total	26.4	21.6	37.8	35.3	2.8	4.4	67.1	61.3	128.3	52%